METAL SHOW ISSUE

American Machinist

OCTOBER 19, 1959

THE MAGAZINE OF METALWORKING MANUFACTURING

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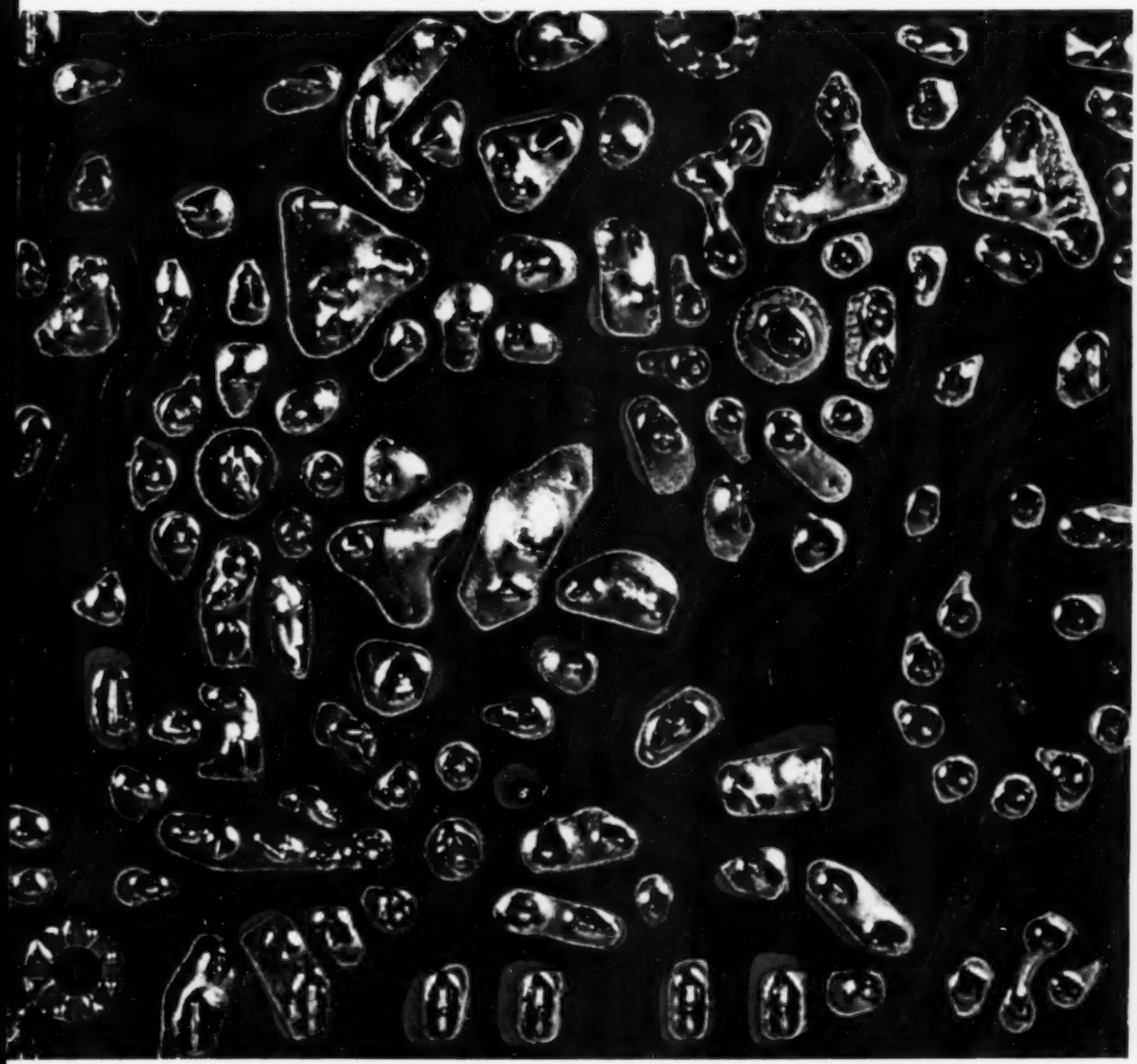

Components assembled to printed circuits by "idiot" machines—see page 160

What's New in PLASMA ARC page 125

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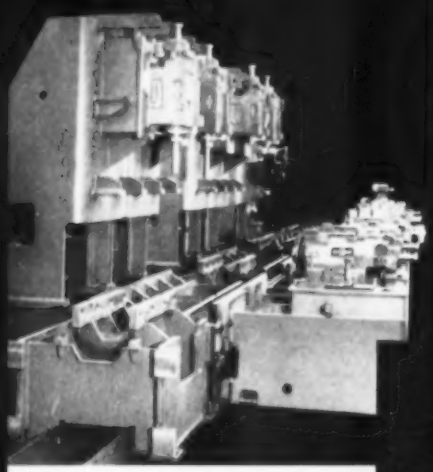
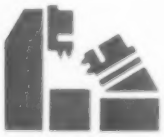
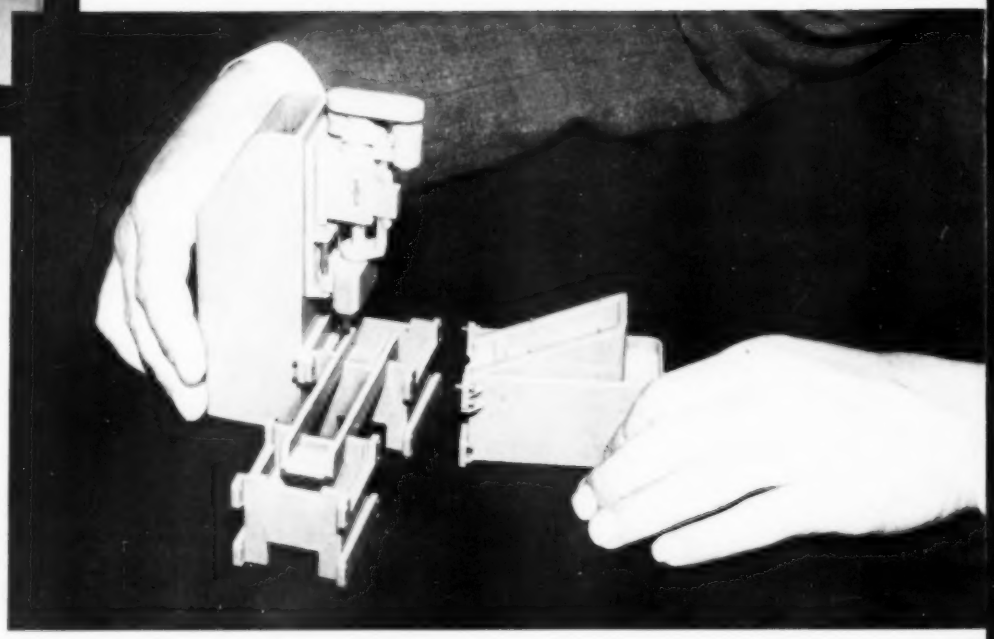
BUILDING-BLOCK AUTOMATION...



This 15-station Model S Bore-Matic, in process of assembly at Heald, shows the application of standard base and wing components for vertical and horizontal mounting of 20 Heald BORIZERS. Machine will perform 174 drilling, spot drilling, tapping, spot facing, core drilling, reaming and gun drilling operations on automotive transmission valve bodies.



Scale model of standard building block units for automated Borizing equipment, showing two center sections, a vertical column with BORIZER in position and a horizontal wing base with angular column for BORIZER mounting.



It's HERE, at HEALD, right now!

WHETHER you call it "modular construction" or "building-block design," it's already an accomplished fact at Heald.

Recognizing that standardization of components for automated Borizing equipment can effect *substantial savings* in initial cost and job changeovers, Heald has designed and built standard center sections, wing bases, angular raising blocks, vertical columns and slide units which can be integrated to perform virtually any combination of roughing, semi-finishing and finishing operations. The Heald system of basic components is fully compatible with the proposed new INDUSTRY STANDARDS, which mark a major advance in the application of automated production equipment.

These standard components are ideally suited to the use of Heald BORIZERS, tooled to the requirements of any job. Changeovers are simply a matter of replacing or adding basic units, modifying workholding equipment if required, and retooling the BORIZERS. Completely self-contained Heald Red Head BORIZERS, providing flexible control of feeds and speeds, simplify retooling and recycling, permitting the most versatile building-block arrangement obtainable.

Ask your Heald engineer to schedule a scale-model demonstration of the new modular design.

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

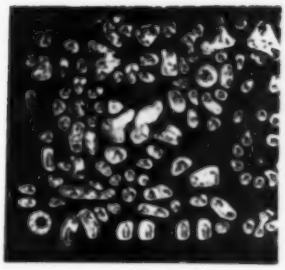
Chicago . Cleveland . Dayton . Detroit . Indianapolis . Syracuse . New York

HEALD

CIRCLE 151 READER SERVICE CARD

COVER:

Just about half of the circuitry of a modern TV receiver can be built into printed circuits. But component assembly is only partly mechanized—for the good reasons detailed on page 160.



American Machinist

THE MAGAZINE OF METALWORKING MANUFACTURING

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TURN PAGE FOR METALWORKING REPORT →

METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Milling with Electrolyte

"Electro-chemical milling" is a new method for machining high-strength steel parts with contours too difficult for conventional milling techniques. The process is similar to chemical milling but instead of a simple chemical bath into which parts are submerged for etching, an electrolyte is used. An electrical charge in the chemical bath eliminates absorption of hydrogen by the work and prevents hydrogen embrittlement.

Columbus Division of North American Aviation, Inc, developed the process and Cleveland Pneumatic Industries Inc, of Cleveland, Ohio has been licensed to use it in the production of ultra-high-strength steel landing gear assemblies and other highly stressed aircraft parts. Most of these components are forgings with a decarburized surface layer that must be removed to prevent adverse effects on mechanical properties. The difficulties encountered in removing the decarburized layer by mechanical milling led to the development of electro-chemical milling. Although the process is quite different from chemical milling, metal removal can be controlled more accurately at about the same rate.

Residual Machining Stresses

When a part bends or warps without any apparent cause, it usually does so because of internal stresses set up by plastic deformation in the material. In some cases these stresses can be eliminated entirely; in others, holding them to a minimum is about the best you can do. The Special Report beginning on page 137 points out the causes of such stresses, and shows how they can be controlled.

Chem-Milling Honeycomb

Contoured steel or aluminum honeycomb is now being produced to tolerances of ±0.003 (for aluminum) and ±0.002 (for steel) by chemical milling at Northrop Corp's Norair Division, in cooperation with Turco Products Inc, which ultimately will license the process.

Negative is cast from a master pattern in plaster, is sprayed or coated with vinyl, and cured. Honeycomb core is then pressed through the mask and into the negative, and the cavity is filled with hot core seal. Negative is then rinsed and the exposed area is removed by chemical milling in 5 to 10 minutes. Maskant and core seal are stripped off and the result is honeycomb contoured to the most complex shapes at savings up to 75% over conventional "machine and crush" methods. See p133.

FORMING

Zinc Forming Dies

Cast-iron dies were used at Martin Co's Baltimore Division, to form light-gage 321 stainless steel into the flanged half of a 90° tube bend. The semi-circular depression in the 18 x 18 in. die block measured 3 in. wide by 1½ in. deep, and the groove met the die face with essentially no radius.

Tests made by Martin's manufacturing research division showed that the job could be done satisfactorily with Formaloy zinc-base forming alloy. This material is made by the Federated Metals Div., American Smelting & Refining Co. Savings in time and money for building and repairing dies are reported.

Stainless in thicknesses of 0.025 and 0.032 in. was satisfactorily formed without deforming the sharp die corner or edge.

Fast Presses

Presses that operate at 1000 strokes per minute are not commonplace, but the number of makes is growing. E. W. Bliss Co., for example, recently shipped a straight-side press that operates a 3-cavity die at this speed.

The press is now in use at Waldes Kohinoor, Inc., Long Island City, NY, for making Truarc retaining rings and other fastening devices. Most important feature of the press is said to be a counterbalancing system that reduces vibration. An electric clutch makes possible rapid torque build-up and fast stops.

HEAT TREATING

Continuous Vacuum Treatment

Prior to the development of vacuum and atmosphere heat treatment, standard practice for treating strip steel was to treat one roll at a time, then clean off the scale in a pickling bath. Vacuum has eliminated the scale problem. Now, the F J Stokes Corp, Philadelphia, Penna, is working on development of roller-type seals to pass a continuous sheet in and out of the heat-treating furnace without impairing the vacuum.

New Furnace Developments

Several furnace manufacturers are introducing new heat-treating equipment at the Metal Show in Chicago. For a quick rundown on what's new in this field, see the New Metalworking Equipment section of our Metal Show in Print, beginning on page 152.

Heat-Treat Coatings

A series of coatings that protects metal surfaces during heat treating has been developed jointly by North American Aviation and Rinshed Mason of Anaheim, Calif. Skalix coatings can be sprayed, dipped, or rolled on to protect surfaces of stainless, Inconel, and superalloys from scaling during heat treatment—without the need for atmosphere control. When work is quenched, the coating spalls off. A more viscous coating (dip only) will protect high-carbon steels from decarburiza-

tion. (For a similar development in this field, see AM—Aug 24 '59, p3.)

INSPECTION

Leak Test

Low-cost production inspection of hermetically sealed devices is now possible by use of non-toxic, inert radioactive gas. Each "leaker" is detected by a scintillation counter.

The non-destructive testing method is being applied by the Potter & Brumfield division of American Machine & Foundry Co, at Princeton, Ind. Work being tested is a hermetically sealed relay. Quality of sealing is detected by the Radiflo system built by American Electronics, Inc, Los Angeles. Leak tests can be made on sample units, after a change in production methods, or automatically for regular inspection of all work produced.

The work is exposed for a prescribed time to the gas under pressure, and is then air washed to remove any radioactive material from external surfaces. Usually, an acceptable leakage rate is determined by relating the time under pressure and the amount of radioactivity detected after exposure.

WELDING

Piggy-Back Heat Treat for Welds

A pancake - type induction coil mounted on the weld carriage behind the arc has been proposed as a way to arrest the cooling cycle and thereby effect short-term isothermal transformation when welding certain titanium alloys. The distance from the welding torch to the coil would be adjustable so the cooling could be arrested at any desired level.

The technique is being investigated by Watertown Arsenal and Redstone Arsenal, according to a paper prepared by C E Hartbower, G M Orner and D M Daley, Jr, for the Fall Meeting of the American Welding Society.

Gas quenching is also being studied for alloys where a "solution-treated" condition is desirable in the weld joint. High arc-travel speed and water-cooled copper backup will be employed, and in addition, the argon will be precooled before being supplied to the trailing shield. These welds will also be strengthened by a "flash-anneal" aging treatment. The trailing coil will heat the weld to 1100 to 1300 F for a few seconds.

If successful, the technique could become valuable in many other welding applications.

Wide-range Foil Welder

Precision seam- and spot-welding machines normally operate within a narrow range of material thicknesses, but a new seam welder announced by Vacuum Tube Products, a division of Hughes Aircraft Co, Culver City, Calif, can handle thicknesses from 0.001 to 0.010 in.

Versatility is based on a phase-shift heat-control circuit that is adjustable to low heat settings and yet is claimed to be stable at full power output (2.8 kva). It is said to work well on stainless steel, nickel alloys, Kovar, and other new alloys.

A spot welder employing the same principles but having added controls can make full-cycle or half-cycle welds in material ranging from 0.0005 to 0.035 in. thick.

ASSEMBLY

Air-Tight Assembly

To keep air from being trapped inside electronic transducer assemblies while they are being covered with air-tight rubber shells, engineers at the Martin Co, Baltimore, slip on the shells while the transducers are submerged in a bath of castor oil. The assemblies, as parts of sonar equipment, are used under water; the rubber shell prevents short circuiting.

The castor oil, which remains inside the shell, has good dielectric properties and is a good conductor of sound energy.

PW Boards for TV

Assembly of television sets has become highly mechanized, chiefly because of printed circuitry. But there is still a considerable amount of hand work involved.

At the Philco Corp plant in Philadelphia, PW (printed wiring) boards are made in a separate facility, then sent to an assembly building that turns out finished TV sets. For a description of their manufacture, together with numerous examples of Philco assembly techniques, see the cover story beginning on p 160.

THE OUTLOOK

More and more metalworking plants will shut down or cut back for lack of steel in the next few weeks. Even with a quick strike settlement, pipelines won't be filled to pre-strike levels much before the end of first quarter 1960 (see p117).

FINISHING

One-Coat Porcelain Enameling

Direct application of porcelain enamel to steel, without the usual undercoat, is now possible through application of the Ray-Davis process introduced by Chas Pfizer & Co Inc, New York, NY. Adaptable to existing plant facilities, the process involves the use of citric acid in the pickling bath in place of the usual sulfuric acid. According to Pfizer, the citric-acid pickle leaves the steel in such a condition that the cover coat enamel can be applied directly. Bond and finish characteristics are said to be excellent, equal to, and in many cases superior to, the bond and finish obtained with conventional double-coat application.

Water-Soluble Varnish

Two German companies, Dr Kurt Herberts & Co, Wuppertal, and Reichold-Chimie AG, Hamburg, are now producting water-soluble varnishes for industrial use. Eliminating organic solvents not only means lower cost, but does away with fire hazards and the need for costly health and safety precautions. Furthermore, overspray can be reclaimed and defective coatings washed off.

Exceptional adhesion is claimed for the water-soluble resins, even on aluminum, and very thick coats can be applied. There is very little settling of the pigments, so the varnishes are ready for use even after long storage.

Flame-Plated Knives

Flame plating of carbide onto steel is no longer a new process, but an interesting development is in the production of kitchen knives by the Robeson Cutlery Co Inc, Perry, NY. With the Linde process, a coat of carbide is plated in a narrow strip down one side only of the knife blade, so that as the knife is used the steel portion gradually wears away to expose more and more of the keen plated edge.

METALWORKING REPORT . . .

MATERIALS & COMPONENTS

Hot Atoms Closer

Atoms in gaseous molecules at very high temperatures are often closer to each other than at low temperatures in the solid state. This knowledge, proved by a new technique developed by an international team of scientists at Cornell University, will enable other scientists and engineers to better cope with the problem of intense heat in space travel and to develop new uses for existing elements and compounds.

During the past year, Cornell scientists converted their electron diffraction apparatus for high-temperature operation. In many materials, they discovered, atoms are still close together in the gas at temperatures up to 1000 degrees Kelvin. Although a few scientists suspected that gases tend to polymerize at extremely high temperatures, no one had succeeded in measuring the distance between atoms and proving it.

Current for Cooling

Pass electricity through most metals and they become warm. That's the basis, of course, of all resistance heaters. However, when you pass an electrical current through dissimilar metals, the junction between these metals becomes either a heat sink or a heat source depending upon the direction of current. This principle (Peltier effect) could become the basis of no-moving-parts refrigerators, air conditioners and other heating-cooling devices. Bismuth and tellurium appear to be most promising metals discovered for cooling so far.

MANUFACTURING CONTROL

Electronic Fact-Gathering

A network of reporting stations on the production line, the IBM 357 Data-Collection System enables workers to feed information on work-in-progress without leaving their work areas. Employees send in reports by inserting pre-punched cards in input stations; at a central office, the cards are automatically reproduced, ready for runs through data-processing machines.

System permits analysis of vital production statistics in minutes. Rental costs per month for each input station are said to be below $100.

The system has the following components:

- Reporting or input stations (about the size of a time clock) that read and flash data to a central point from "man" and "job" cards fed into them by production workers. A small keyboard, affixed to input stations, enables workers to enter variable information.
- A control unit, acting much as an automatic telephone switchboard, that sequences data transmissions as they are initiated from the various input stations. Up to 20 input stations can be wired through a single control unit.
- The central or output station, which reproduces the punched-card data.
- An optional automatic clock that will insert time into the punched cards.

The system can be purchased outright or rented on a monthly basis.

Reducing Costs

As part of its continuing cost-reduction program, the Seattle Division of Boeing Airplane Co issues a monthly report on each cost-saving item submitted by its departments. Purpose is to publicize ideas that other divisions can use.

Here are selected items from a recent report:

- Packaged pop-up tissue, instead of expensive gauze pads, for cleaning sealing tools and sealers' hands, is expected to save $21,500 a year.
- Elimination of Requirements Ledger stickers summarizing part number requirements will save $26,000 annually.
- Development of a reproducible master vellum, describing lengthy specifications, permits attachments of a reproduced copy to purchase orders or related papers. This eliminates duplication in typing and reduces proof reading. Annual savings: $5400.

Combining a grid and title master on a drawing board with an acetate overlay on which data is posted eliminates need to renew masters in the preparation of quality performance charts. Annual savings: $3100.

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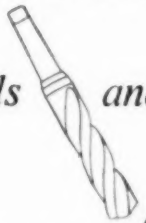
Dependable Productivity...*the common denominator*

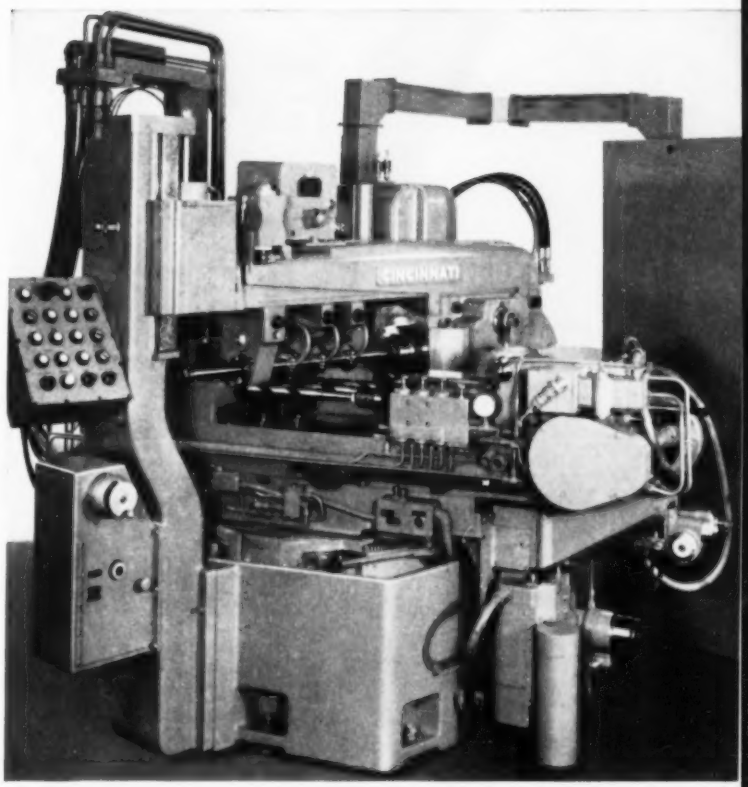
for Drills  *and Transmission Cases machined on equipment*

built by **CINCINNATI** | **SPECIAL MACHINE DIVISION**

There's no resemblance between drills and aluminum transmission cases, nor in the machining operations required to produce them. But both have a common denominator; they're machined at low cost on dependably productive equipment built by Cincinnati Milling's Special Machine Division.

Flutes in drills and various types of cutters are automatically machined in groups of three on CINCINNATI Spiralmatic Milling Machines, a new type of equipment developed especially for low-cost fluting operations. Although the machine can be classed as "single purpose," it has a high degree of flexibility within its own right. The spindle head is the automatic rise-and-fall type, raising the cutter off the work before the return stroke of the table. For various helices, the table can be swiveled from 0 to 45°. Spindle speeds range from 75 to 3000 rpm. Electro-hydraulic lead and indexing fixture provides leads from 2½" to 75" and indexing of 2, 3, 4, 6, 8, 12 and 24.

Twist drills, cylinder blocks, controlled metal chips for chemical reactions, month wheels . . . all are produced more accurately and at lower cost on machines built by Cincinnati's Special Machine Division. Another example of their work – a complete production line for transmission cases – is illustrated on the two pages following. **Special Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



SPIRALMATIC MILLING MACHINE automatically mills helical flutes in twist drills and similar types of work three at a time.

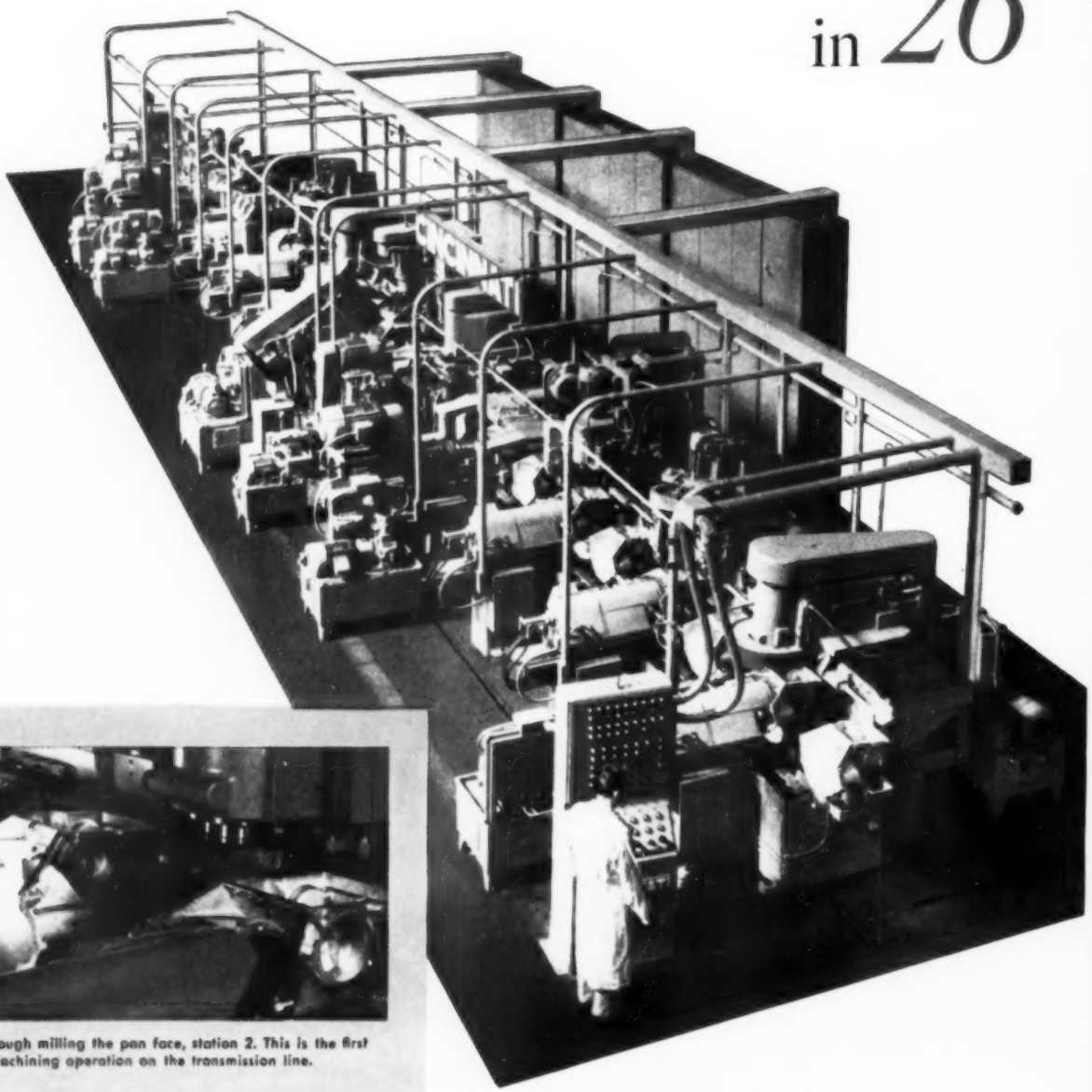
CINCINNATI®

SPECIAL MACHINE DIVISION

SPECIAL MACHINES • VERTICAL AND HORIZONTAL
BROACHING MACHINES • COMPLETE PRODUCTION LINES

CIRCLE 154 READER SERVICE CARD

CINCINNATI | SPECIAL MACHINE DIVISION incorporates in 26



Rough milling the pan face, station 2. This is the first machining operation on the transmission line.

CINCINNATI 26-STATION TRANSFER LINE at Ford Motor Company's new plant in Sharonville, Ohio, automatically bores, mills and drills automatic transmission cases in 33 machining operations. Accuracy and finish are excellent. The machine cycles 137 times per hour.

DESIGNERS AND BUILDERS OF SPECIAL MACHINES • VERTICAL AND HORIZONTAL BROACHING

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CIRCLE 155 READER SERVICE CARD

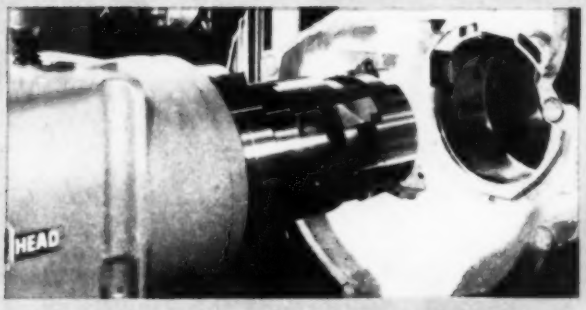
Dependable Productivity

-station TRANSFER LINE . . .

Aluminum transmission cases require gentle handling and firm, balanced clamping during the machining operations . . . and a high degree of dependability in the production equipment. All these requirements are incorporated in the CINCINNATI 26-Station Unit Type Transfer Machine illustrated at the left. This production line mills, drills and bores Ford automatic transmission cases; inserts two bushings; automatically banks excess parts; transfers the casting from one station to the next. There are 26 stations, allocated as follows: 10 for machining, one for inserting bushings, one for banking, one for future engineering changes, and the remainder for other functions required in a modern transfer line. Several outstanding advantages are incorporated in this line, including unit construction and complete static electrical control.

Cincinnati engineers and builds special machines and complete production lines varying in complexity from small bearing-shell broaching machines to giant production lines performing a multitude of operations. Make Cincinnati your first choice for equipment of this type. The Special Machine Division is ready to serve you.

CINCINNATI



Boring and chamfering the large diameter. At the same time, boring and facing operations are performed from the other end. Station 8.

Inside the transmission case. Hard-to-reach surfaces are easily machined on the CINCINNATI Transfer Line.

MACHINES • COMPLETELY AUTOMATED PRODUCTION LINES

CINCINNATI®
SPECIAL MACHINE DIVISION

CIRCLE 156 READER SERVICE CARD

Accurate, High-Speed **GEAR** at

58-tooth gear, 11 N.D.P.,
17° 49′ helix, 2″ face
width.
Grinding allowance:
0.014″ over pins.
Material: 4140 steel,
245-285 Brinell hardness
Grinding time: 15 minutes.

14-tooth pinion, 11 N.D.P.,
17° 49′ helix, 2½″ face
width for full depth
teeth.
Grinding allowance:
0.012″ over pins.
Material: 4140 steel,
269-321 Brinell hardness
Grinding time: 8 minutes.

Tolerances:
Lead—0.0001″ per inch.
P.D. runout—0.0005″ T.I.R.
Involute profile—
plus 0.000, minus 0.0002″.

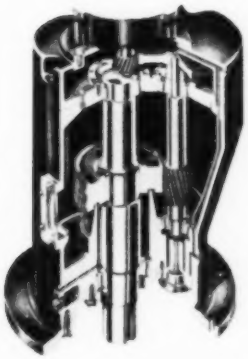
Reishauer Gear Grinding Machine

THE
PRECISION
LINE

Fellows

GRINDING

PHILADELPHIA GEAR



When speed reducer gears need that extra degree of precision for smoother, quieter operation, the well-known Philadelphia Gear Works grinds them on a Reishauer because it is accurate and fast. For example, grinding time was only 15 minutes for the gear and 8 minutes for the pinion shown on the opposite page.

Gear grinding by the Reishauer method is a generating process. The involute gear teeth are generated by a grinding wheel on which a helix has been developed. The tooth section of the wheel is usually that of the basic involute rack.

Fellows builds the No. 12 Fellows-Reishauer Gear Grinding Machine under license from Switzerland's Reishauer Tool Works. The No. 12 grinds in both directions of travel of the work-slide and has a built-in device for crown grinding. Short set-up time permits the economical production of single pieces as well as long runs.

Capacities for the No. 12 are: Max. O.D., spur and helical, 12"; Max. face width, *spur*, 6¾"; Max. face width, *helical*, depends on pitch and helix angle; Pressure angles, 14½° to 30°; Pitch ranges (two lead screws are available), 6 to 48 D.P. or 20 to 120 D.P.

Grinding gears by the Reishauer method will give you precision gears at real production speeds. Ask your Fellows Representative about it.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Avenue, Royal Oak, Mich.
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

Gear Production Equipment

Shipping as Scheduled...

to thread for another LANDIS customer

"Delivery as promised" is an important part of LANDIS Service to its customers. A delivery date is a promise—important to the customer—and therefore important to us.

Many men and many operations are required to produce a piece of LANDIS Threading Equipment. They are precision production Tools and Machines—cannot be produced by production-line methods, but require individual skilled attention. To put these men and operations together to produce a specific LANDIS Tool or Machine on a specified date requires continuing effort and attention.

But, in Delivery and Production Scheduling—as in Sales, Service, Design, Engineering—all LANDIS efforts are directed to maximum satisfaction and convenience for our customers. Though the world's largest in our field, our size is geared to better customer accommodation—adequate inventories, service when needed, skilled engineering, continuing research.

When faced with the need for Threading Equipment—for expanded operations or new operations—perhaps requiring specialized design and engineering—call LANDIS. We offer the most complete line of Threading Tools and Machines available in the world today.

565C

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Threading Machines

Die Heads — Rotary & Stationary

Centerless Thread Grinding Machines

Taps — Collapsible & Solid Adjustable

Thread Rolling Machines

Thread Rolling Tools

CIRCLE 160 READER SERVICE CARD

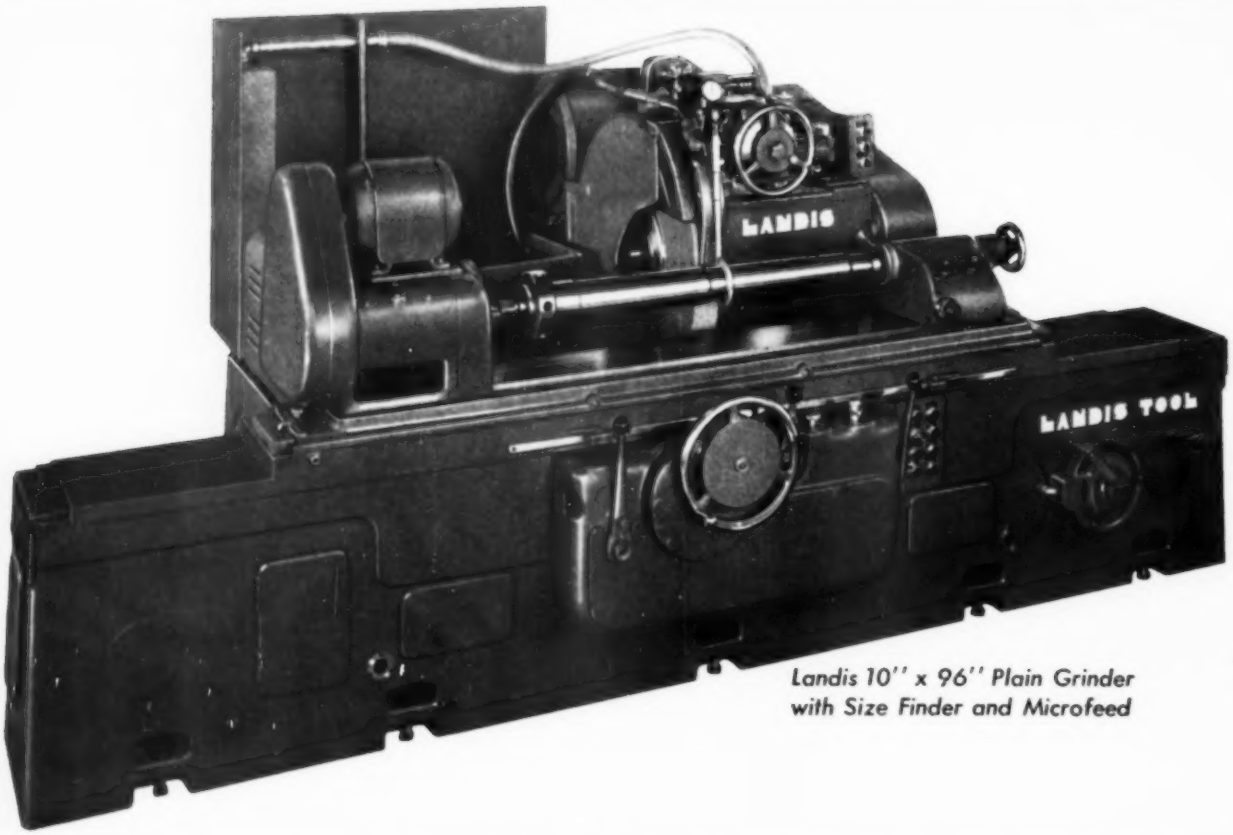
New idea cuts cost

LANDIS size finder with MICROFEED

Positive direct reading size finder cuts setup time

Landis MICROFEED assures "tenths" tolerances consistently

Eliminates costly rejects

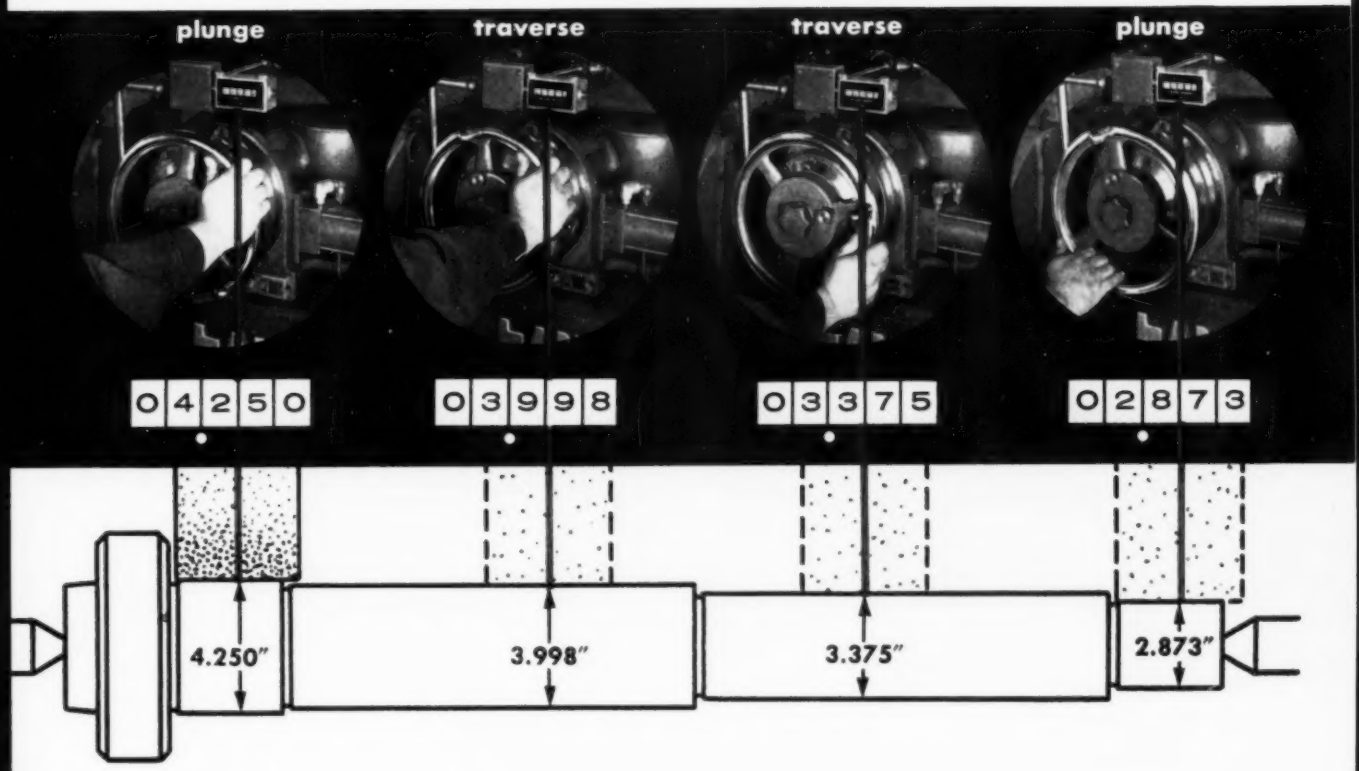


Landis 10" x 96" Plain Grinder with Size Finder and Microfeed

# of grinding shafts

shows remarkable savings on small lots

finish sizes set on direct reading dial



how size finder works

The operation of the machine is simple, even for unskilled operators. It's only necessary to set the finish dimension on the indicator by turning the wheel feed handwheel. Operator starts the cycle, applies the sizing gauge and stops the cycle when the gauge shows finish size. He moves the work table, resets the Size Finder for the next diameter and repeats the cycle.

You can make large savings on your small lot multiple diameter shaft grinding operations. Send us prints of your shafts for our proposal.

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

MORSE

helps to make

MACK

mighty...

two famous names noted for

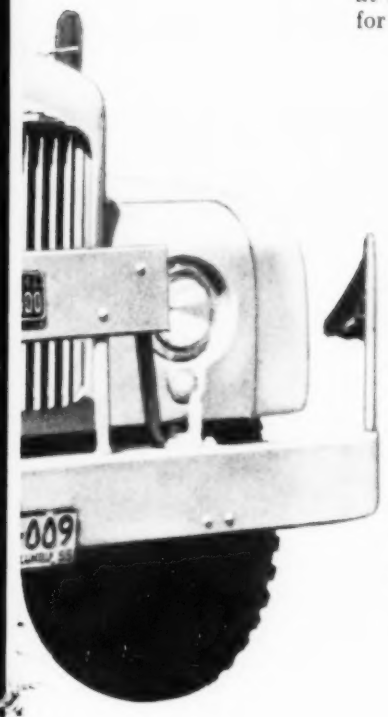
GUTS

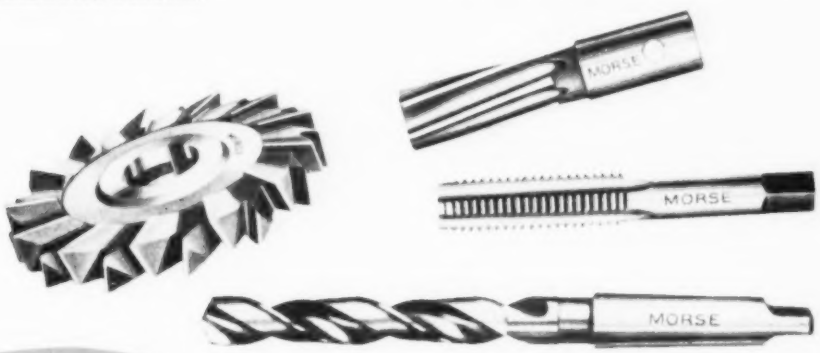
Mighty Mack Trucks . . . and the Morse cutting tools used to make them . . . are equally famous for *guts*. Mack on the road. Morse on the production line. Proof once again that to build the best you must build *with* the best.

Sound economics? Sure. Longer lasting more efficient tools *invariably* produce long-run economy.

Why not prove it to yourself. Your Morse-Franchised Distributor will gladly demonstrate to you the *practical* economics of buying the best in cutting tools . . . Morse, of course. *Call him in today.*

P.S. If you want to get the most out of the best twist drills made today, take a look at the Morse Production Drill Point Grinder. It *outpoints all other* machines. Write for new illustrated bulletin.





Morse CUTTING TOOLS

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS

WAREHOUSES IN NEW YORK, CHICAGO, DETROIT, DALLAS, SAN FRANCISCO

A Division of VAN NORMAN INDUSTRIES, INC.

MORSE means "THE MOST" in Cutting Tools

NEW

WARNER & SWASEY

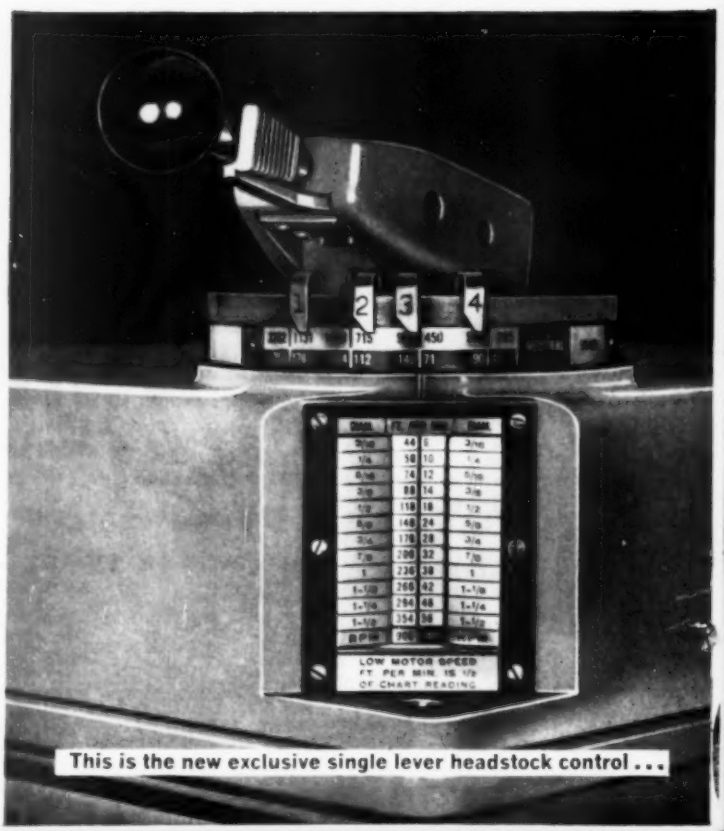
Unique, Automatic Headstock

More Speeds – Greater Range – The new eight-speed headstock (16 with a two-speed motor) gives you more speeds in a wider range – from 45 to 2262 rpm – for maximum metal removal efficiency.

Instant Speed Changes throughout the full range are made possible through exclusive, Warner & Swasey designed direct-acting hydraulic clutches (which never need adjustment) in combination with a constant mesh, helical gear train. Time loss for gear shifting in conventional headstock gear trains is eliminated.

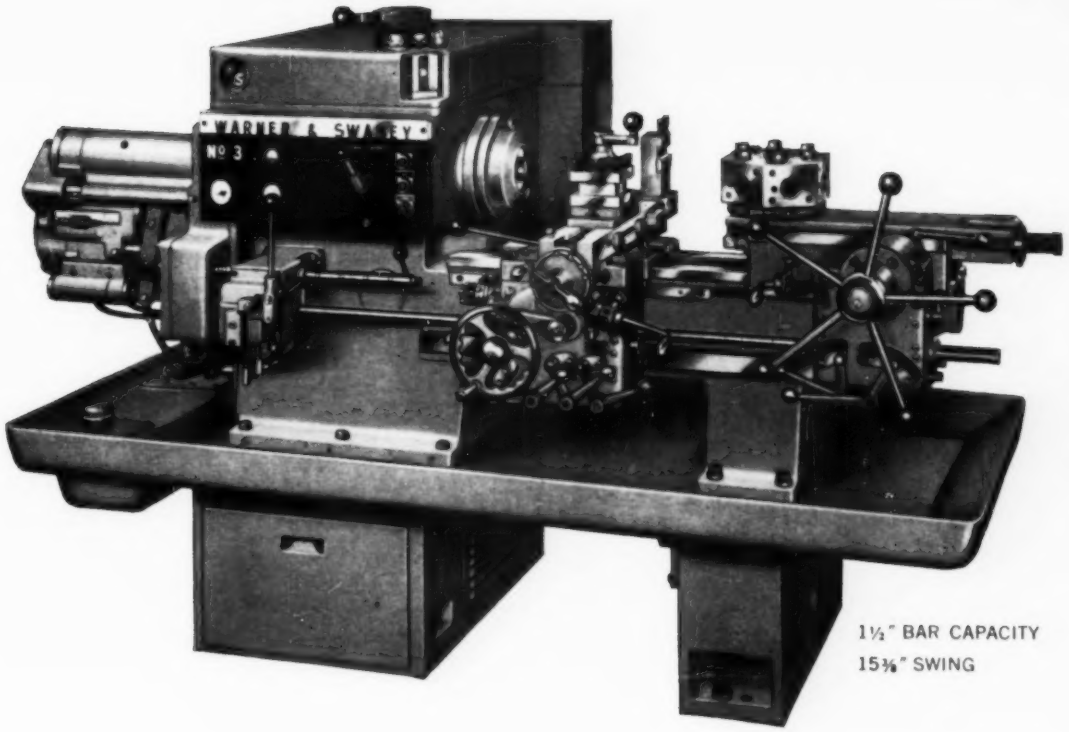
Full Power is always available at the spindle nose by the higher-powered, direct-mounted motor. Direct mounting also eliminates motor-drive maintenance problems.

New, Rugged Bar Feed and Collet Chuck are hydraulically operated with single-lever control for easy, fast handling. The wider base and rigid construction of the bar feed permits greater accuracy and smoother work finishes on high-speed, heavy-duty work.



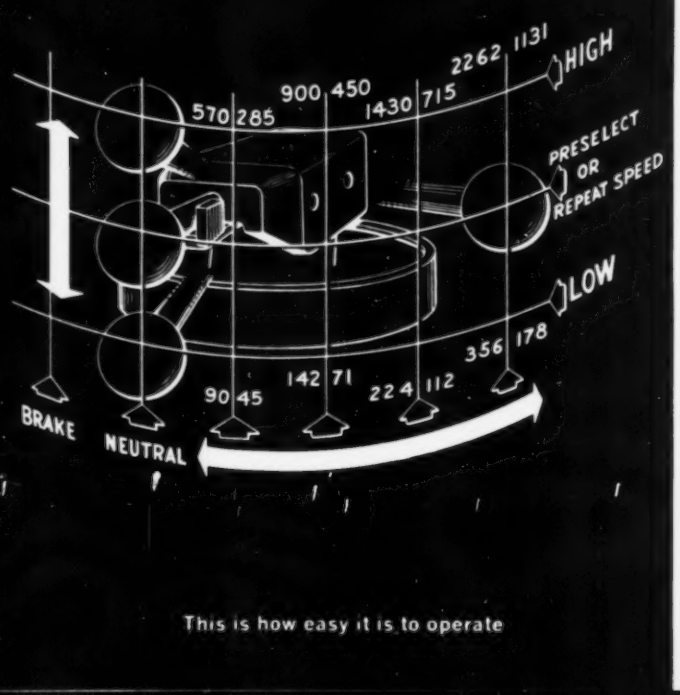
This is the new exclusive single lever headstock control . . .

CIRCLE 165 READER SERVICE CARD



1½" BAR CAPACITY
15⅜" SWING

No.3 ram type turret lathe



This is how easy it is to operate

Exclusive, Single Lever Preselector and Speed Control

Control of spindle speeds is now an easy one-hand operation on the new No. 3! Preselection of speeds, speed change, brake and neutral—all are obtained with the same lever!

No fumbling for speeds... no gear shifting. Just rotate the handle to preselect; move it up or down to engage new speed instantly.

No figuring... the direct reading preselector dial tells you the surface speed for each diameter and rpm.

No remembering (or forgetting)... the preselector drum lets you set up the sequence of cuts; numbered clips tell you where to find the speeds and their order of use.

Neutral (free spindle) and Brake are selected by rotating lever to the left.

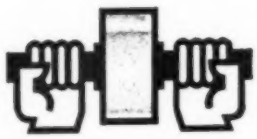
Forward and Reverse are controlled by a switch lever on front of headstock.

For free brochure write Warner & Swasey Company, Cleveland 3, Ohio.

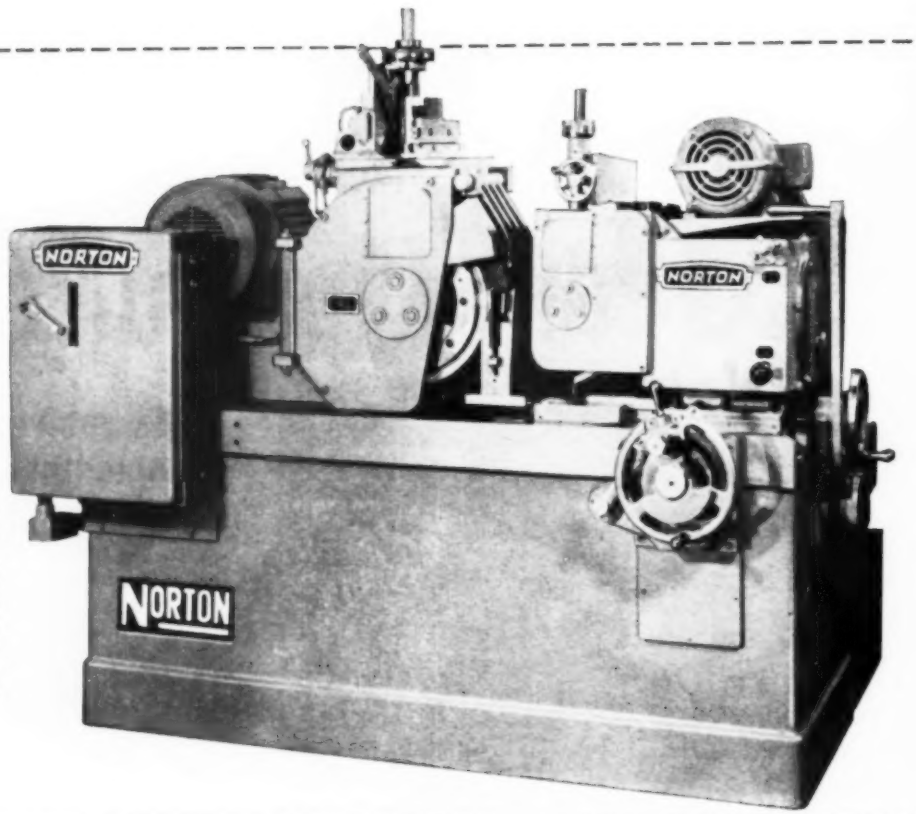
You can produce it better, faster, for less... with a WARNER & SWASEY

Newest NORTON Grinder!

The No. 2 Straddle-Bearing



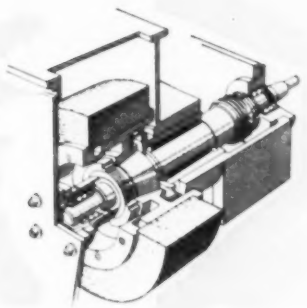
Centerless is built for speed . . .



Ready for Immediate Delivery

The new Norton No. 2 Centerless Grinder can be arranged for full automatic, semi-automatic or manual thru-feed or plunge grinding. Capacity includes work diameters ranging from 1/16" to 4 3/4" depending on type of work rest and bar grinding fixture.

3 MAJOR ADVANCEMENTS IN CENTERLESS GRINDING



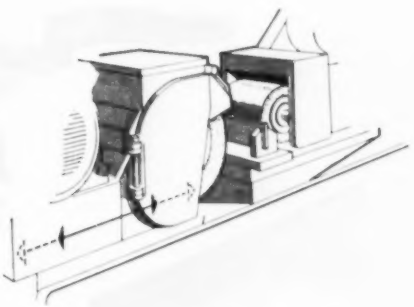
accuracy . . . economy

Straddle-Bearing Spindle Support, in both grinding and regulating wheels, provides extra strength. Combined with the inherent rigidity of Norton spindles this boosts capacity to take heaviest cutting pressures, while permitting fast grinding to close tolerances under all conditions.

Like all Norton grinders and lappers the Norton No. 2 *Straddle-Bearing* Centerless Grinder is built to deliver "Touch of Gold" performance — the Norton extra that adds value to your product while cutting your production costs.

You'll find plenty of proof of that in the modern construction of this newest machine of its type. *Straddle* support of spindle bearings adds strength and ability to take tough jobs . . . the mobile wheel head and constant work-loading alignment make jobs shorter and easier.

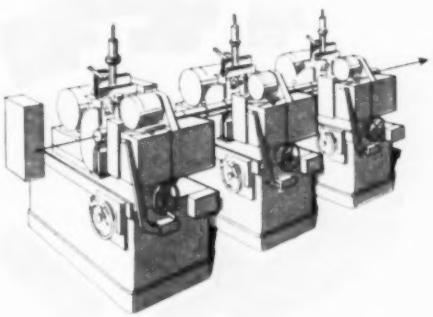
Many other features result in outstanding performance advantages. Call your Norton Sales Engineer, a trained expert in the grinding field, for consultation on how these features can benefit your production. Or write for Catalog 1328. NORTON COMPANY, Machine Division, Worcester 6, Mass.



Mobile Grinding Wheel Head, with wheel mounted between head ways and feed screw located beneath wheel center for ideal balance, provides instant response to signals. This results in especially fast sizing, one of many important advantages over fixed head operation.

NORTON
GRINDERS and LAPPERS

District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit.
In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.



Work Loading Alignment is never disturbed by wear of either grinding or regulating wheel . . . neither is the alignment of the work rest blade. Movable heads for both grinding and regulating wheels make this advantage possible . . . and especially time-saving in a battery set-up.

Making better products . . . to make your products better
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — **BEHR MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

for management

Some of you have an unnecessary inferiority complex about automation. You think your plant is really too small to enjoy the profits of automated operations.

Actually, it isn't the size of your plant that counts; it's the size of your run which determines how profitable automation can be. Many of our customers are small in square feet, yet they have increased their profits by applying Avey modular automation to all kinds of drilling, tapping, milling, and boring operations.

If you have fairly large runs, don't decide you're too small until you've talked with us about the possibilities. Our proposals might surprise you as being extremely modest. Avey Division, The Motch & Merryweather Machinery Company, Box 1264, Cincinnati 1, Ohio.

It's the size of your run,

for production men

The flexibility of "standard" equipment and the production of "special" are combined in this 62-foot Avey Line-O-Dex machine.

Operations on the jet engine diffuser case include drilling, countersinking, reaming, and lead screw tapping.

One fixture moves both linearly and radially to index the part. Add a second fixture and you double production.

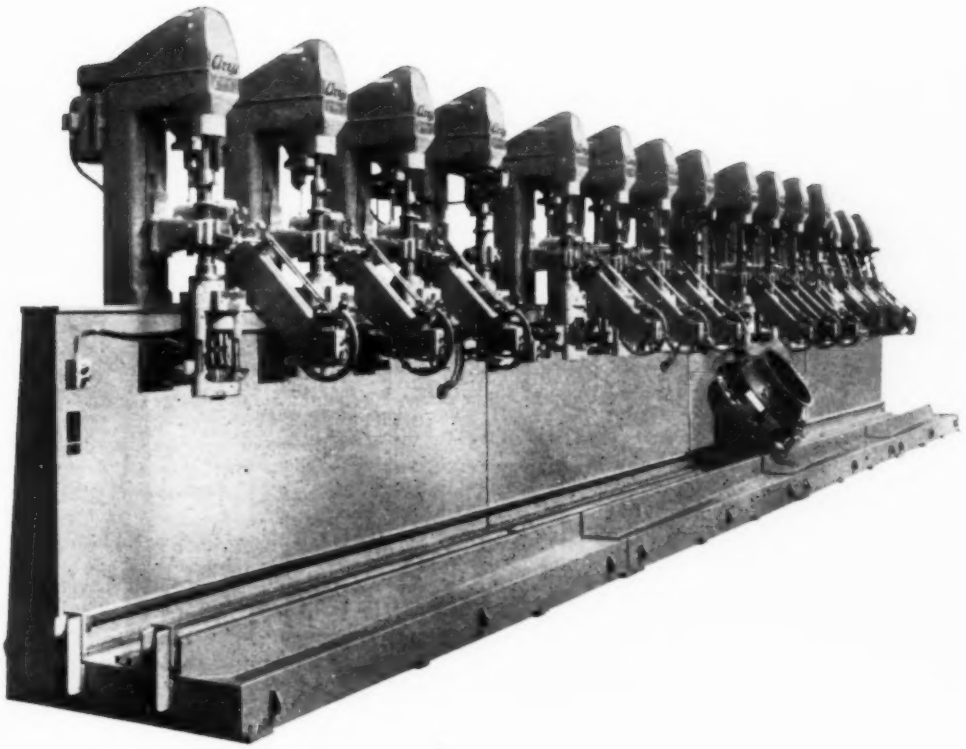
Standard drilling columns are arranged with multiple spindle drill heads which have power feed, four rates of feed, adjustable speeds, and additional head and quill travel to permit easy changeover to a new design.

Transfer mechanism is supported by the base. Another example of Avey's customer-oriented engineering.

Avey

drilling, tapping, production machines

not the size of your plant



Heller nucut *American Pattern* Files

SMOOTHER FINISHES COME FASTER when Heller NUCUT Files sink their double-acting, non-tracking teeth into the work. While coarse teeth are chewing off metal with less pressure and fewer strokes, fine teeth add the finishing touches. Wavy grooves formed by irregular tooth size and spacing break up chips, minimize loading, reduce chatter. Fewer files are used. Files last longer. Filing time and costs are lower than ever before.

SEEING IS BELIEVING! Test Heller NUCUT Files with "Wavy-Teeth" against any other brand. You'll find, size for size and cut for cut, no other file cuts so fast and lasts so long as a Heller. Your nearby Heller Distributor stocks Heller Files in every type, shape, size and cut you'll ever need for faster better filing at lowest cost.

CALL YOUR LOCAL DISTRIBUTOR and Heller for Heller
SERVICE • STOCKS • SAVINGS

HELLER TOOL CO.

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

Branch Offices and Warehouses: Newark, N. J. • Detroit • Chicago • Shreveport • Los Angeles • Portland, Oregon

Here's the quick, low-cost way to get any Controlled Surface Finish

Are you paying more than necessary to obtain *controlled surface finishes?* You probably are if Gisholt Superfinishing is new to you. You are losing time, money and paying a premium for quality as well, on many jobs.

With Superfinish you preselect the surface finish you need—as high as 80 or as low as 1 micro-inch RMS—and you get it faster, at less cost than by any other method. Rather than an expensive extra step, Gisholt Superfinishing actually eliminates tedious, more costly processes.

Not only do you save time and money, but you get a "controlled" surface finish, free of smear metal—with the true base metal exposed—one that provides greater area contact for heavier loads and longer life in your specific application.

Whether your job requires a 1, 20 or 80 micro-inch finish, setup is fast and easy. Nothing is left to the operator's skill or judgment. Stone pressure and grade, and reciprocation rate are preselected to produce the finish you require, for job lots or large production runs.

It will pay you to find out how Gisholt Superfinish can cut costs, improve quality and lengthen service life on your standard or problem parts. Ask your Gisholt Representative or write for Bulletin 1169.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

WRITE FOR FREE ARTICLE REPRINT

"Superfinishing Improves Quality of Automatic Transmission Parts" tells you how Gisholt Superfinishing improves surface finish and geometry, and provides greater wear resistance.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

NOW MORE THAN EVER

MARVEL HIGH SPEED EDGE HACK SAW BLADES

should be **YOUR FIRST CHOICE**

This is no time for "second-best" performance from your hack sawing machines. Today, every cut you make on a hack saw should be done as quickly, accurately, and economically as possible.

The *blades* you use can often mean the difference between mediocre work and top performance from your hack sawing machines. Here are 3 big advantages unbreakable MARVEL High-Speed-Edge Hack Saw Blades can bring to your cutting-off operations:

1 HIGHER PRODUCTION . . .

MARVEL High-Speed-Edge Blades are shatterproof and can be worked harder and faster than any other blade. They will withstand the highest speeds and heaviest feeds attainable on any hack sawing machine with complete safety. Machine operators working with MARVEL Blades naturally apply greater tensions, feeds, and speeds because they know they are safe from personal injury accidents. The result is faster cutting-off.

2 GREATER ACCURACY . . .

MARVEL Blades can be safely tensioned from 200% to 300% more taut than ordinary blades. Higher blade tensions produce greater rigidity of the high-speed-steel cutting edge, resulting in maximum attainable accuracy of cut-off blanks.

3 LONGER BLADE LIFE . . .

Each MARVEL High-Speed-Edge Hack Saw Blade is triple tempered to assure maximum toughness of the cutting edge. MARVEL Blades not only give you longer life, they assure a more efficient cutting life and lower blade costs.

Why gamble? Demand MARVEL Blades by name, and be sure you're getting the best blades on the market. Leading Industrial Distributors have them in stock.

Write for the new MARVEL Cutting Tool Bulletin and the name of your nearest MARVEL Distributor.

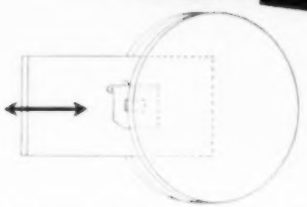
ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

MARVEL *Metal Cutting* SAWS
Better Machines—Better Blades

Gardner gun type fixturing lowers costs in grinding large area and odd shaped parts

surface grinds TWO sides parallel in ONE operation

Gardner 2H30 Precision Double Spindle Grinder with gun type fixturing.



Typical large parts ground with gun type fixturing:

clutch races, bearing cones, valve plates, separator plates, deposit box doors, pump rings.

Advantages of Gardner reciprocating gun type fixturing

- heavy stock removal
- work holding paddles easily interchangeable
- profitable for short runs
- tolerances for flatness, parallelism and uniformity to "tenths"

Ask the Gardner Man for practical recommendations or write for latest catalog.

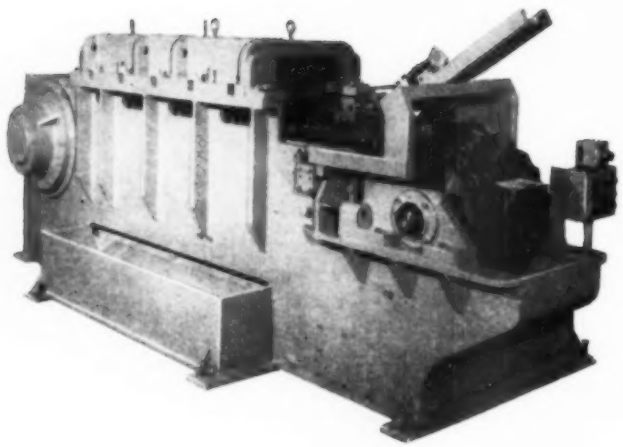
GARDNER

precision disc grinders

BELOIT, WISCONSIN

The European builder of a famous sports car is producing 1400 completely-broached rocker arms per hour on this horizontal

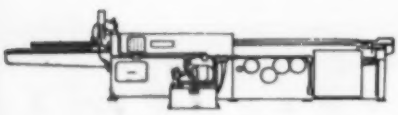
LAPOINTE - CONTINUOUS



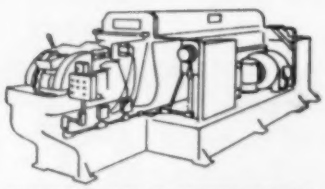
Close tolerance and fine finish are produced in one pass on the 15 hp/66-inch capacity Lapointe Continuous-Broaching Machine which is equipped with manually loaded, automatic clamping, self-ejecting fixtures.

All surfaces are broached simultaneously, using **generating-type action** to minimize the pressures on the parts from the broach cuts and to facilitate chip disposal. And in this particular Lapointe Machine production is equal to that of three conventional broaching machines!

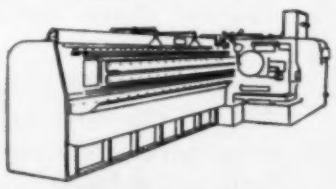
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

Broaching is done after the bronze bushing has been pressed into place, locating from the shaft hole and adjacent face.
Rough forging

BROACHING-MACHINE

Look at all the broached surfaces on the rocker arm forging . . . and then think of getting 700 right-hand and 700 left-hand pieces per hour off this machine! It's not surprising that the Lapointe *Continuous-Broaching* Machine is as popular in that automotive manufacturer's plant, as it is in this country!

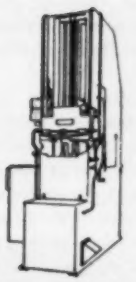
In your plant, are you milling where you might be using Lapointe-Broaching to better advantage? Are you boring, turning, shaping . . . when Lapointe-Broaching could step up your production rate, reduce your costs, *improve your quality?*

If you aren't absolutely sure that your present machining methods are the most practical and economical methods to use, why not invite a qualified Lapointe Field Engineer to consult with you? You may be surprised at the help he can give you, right out of his own experience!

THE LAPOINTE MACHINE TOOL COMPANY

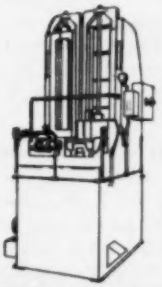
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



VUE-7 VERTICAL PULL-UP ELECTRIC

SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

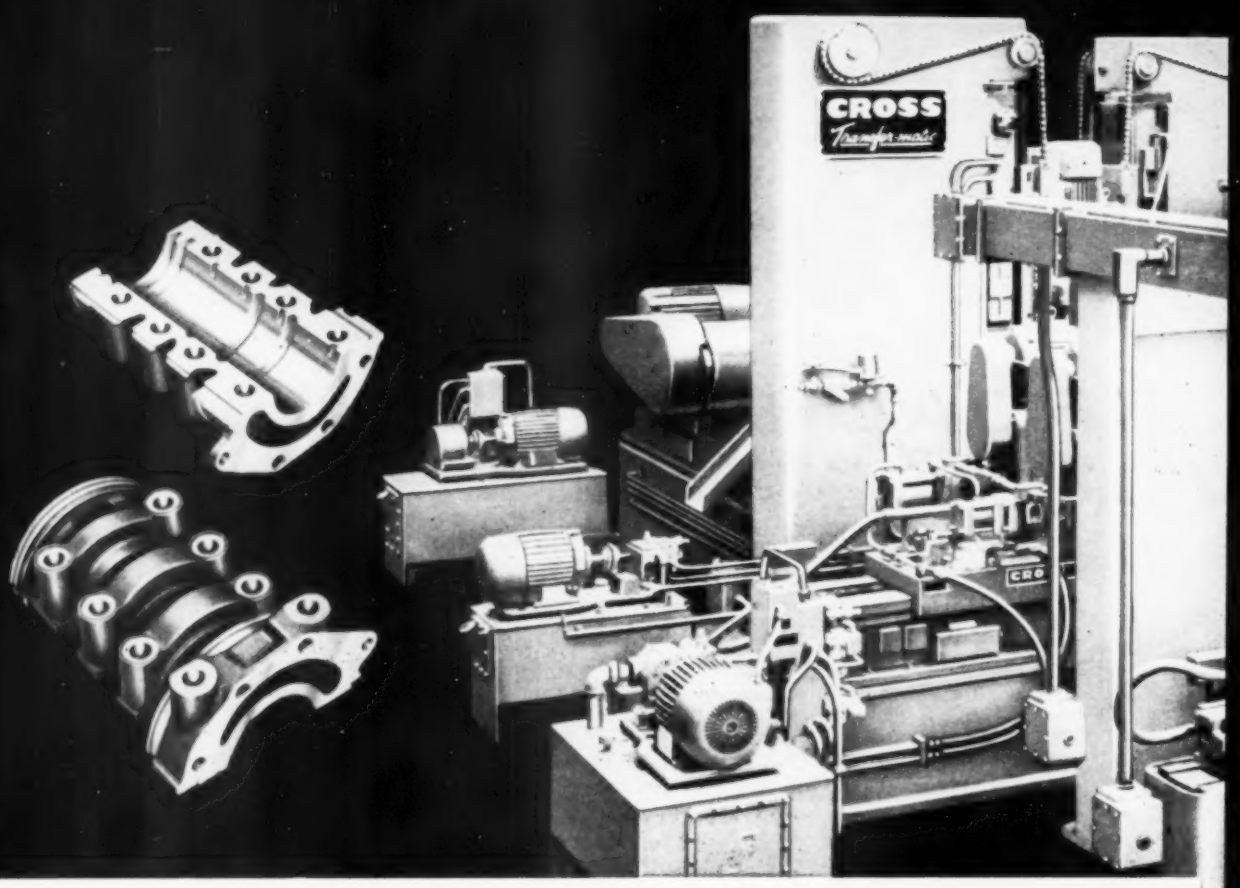
known to be the best in

BROACHING

CIRCLE 176 READER SERVICE CARD

CIRCLE 177 READER SERVICE CARD ►

A New Approach For Processing Crankshaft Bearing Caps



This Cross Transfer-Matic, built for an European automotive company, provides an entirely new approach to machining crankshaft bearing caps. Capacity of the 30 station machine is 109 sets (436 pieces) per hour at 100% efficiency.

The parts, cast in clusters of four, are broached in preparation for the operations performed by the Transfer-Matic. Unlike American designs, the No. 1 and 4 caps require felt seal grooves and the No. 1 cap has a pattern of four holes in the end for mounting a fan belt cover.

New Methods

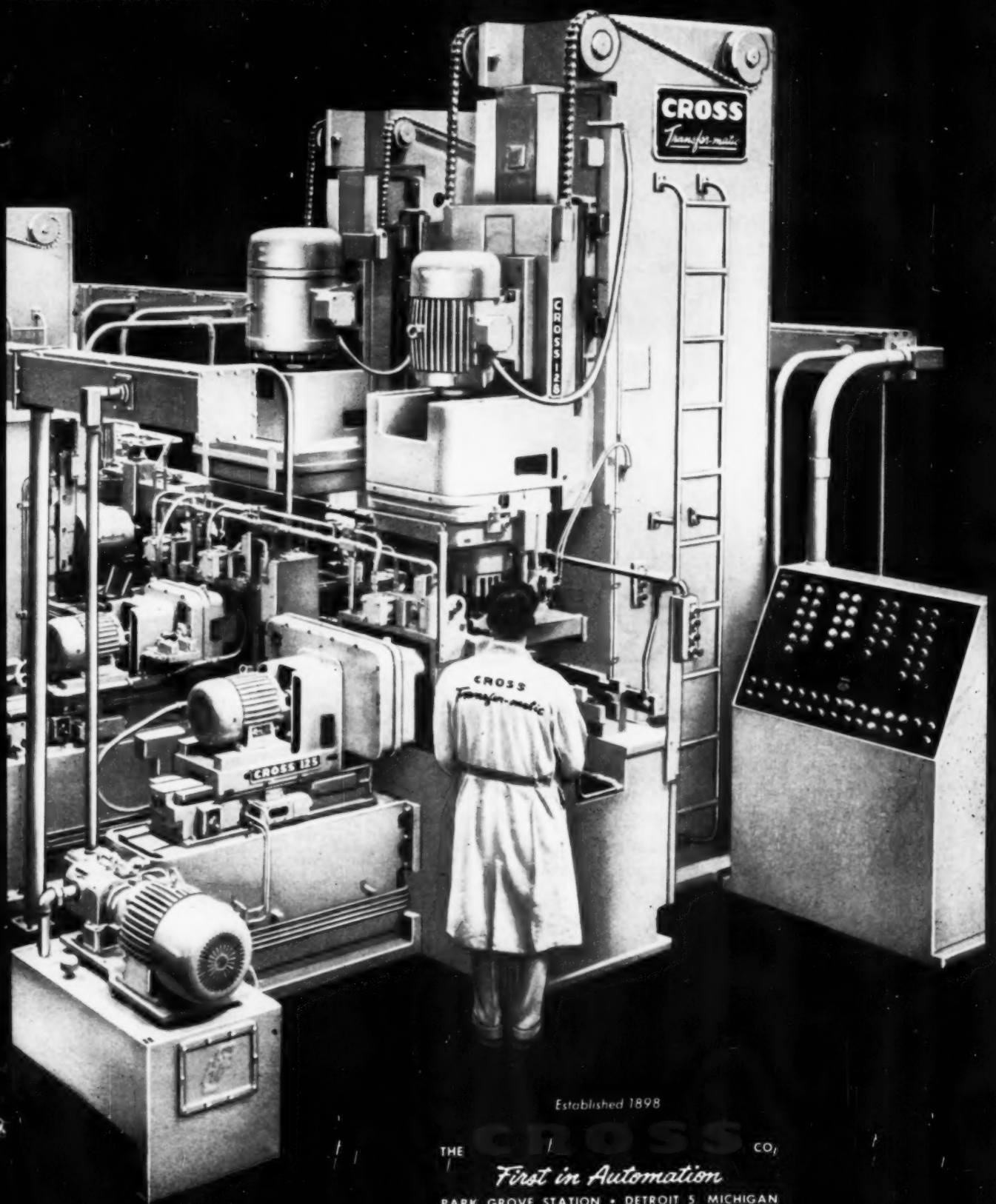
The clusters are indexed by a lift and carry transfer mechanism with the crankshaft axis at right angles to the transfer movement. The felt seal grooves are machined by standard cross-facing heads mounted on horizontal positioning units. The fan belt cover hole operations are also performed horizontally. The bolt holes, bearing lock notches, oil slinger grooves and the milling of a lug on the No. 1 bearing cap are all machined vertically.

New Sawing Unit and Fixture

At the very end of the machine, the clusters are shuttled into a special sawing fixture where they are cut into individual pieces and ejected. The fixture, a new design, holds the parts with the joint face at a 40° angle. This arrangement permits the chips to fall free of the clamping mechanism and substantially reduces the overhang of the sawing cutters. During the sawing operation, locating pins are inserted in all of the bearing cap bolt holes to provide maximum rigidity and to prevent pinching of the saws as they withdraw from the work.

The machine is constructed to JIC Standards, has complete interchangeability of all standard and special parts, and is constructed out of standard Cross building blocks for optimum flexibility. A Cross Machine Control Unit equipped with Toolometers programs tool changes to reduce machine downtime. All tools are pre-set in standard Cross tool setting fixtures.

Another Automation First by Cross



Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5 MICHIGAN

WESTERN UNION
TELEGRAM
TO ALL DIEMAKERS:
TO ALL DIE USERS:
BANKO PATENTS COVERING MECHANICAL HOLDING
OR INTERLOCKING SEGMENTS IN CARBIDE DIES NOW PURCHASED
AND RELEASED TO THE PUBLIC.
CARMET DIVISION, ALLEGHENY LUDLUM STEEL CORPORATION

CARMET®

again serves the Die Industry

Making these Banko patents available, by dedication, for free and public use is another step in Carmet's policy of serving makers and users of carbide dies.

No one appreciates the problems of the die industry more than Carmet, the pioneer supplier and developer of carbide metal used in dies.

Carmet's precision preform methods result in cost-cutting advantages. Practically any shape or size of blank is accurately formed, requiring only a minimum amount of grinding to final dimensions.

All of Carmet's vast production and research facilities are at the service of all die makers. Let our die specialists help you on your problems.

Write to *Carmet Division, Allegheny Ludlum Steel Corporation, Ferndale, Detroit 20, Michigan.*

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ALLEGHENY LUDLUM STEEL CORPORATION

AL®

◀ CIRCLE 178 READER SERVICE CARD

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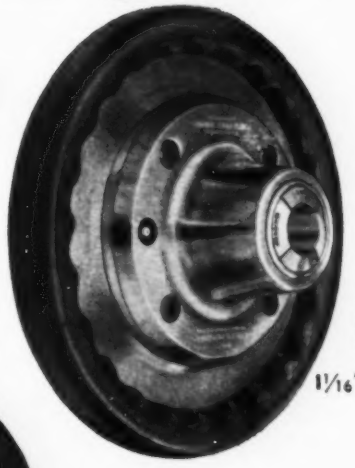
HARDINGE
ELMIRA, N.Y.

HARDINGE Sjogren Chucks

Quality at Low Cost

HARDINGE-SJOGREN Speed Collet Chucks for tool room lathes, engine lathes and grinders.

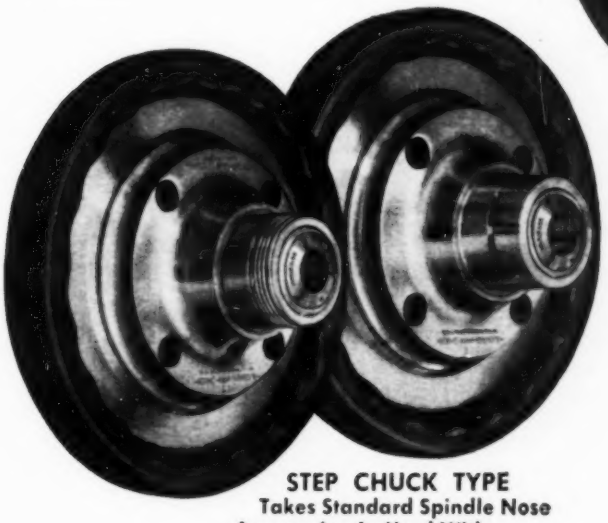
Available for Threaded Nose, Cam Lock, Taper Key Drive and American Standard Spindles.



REGULAR TYPE

AVAILABLE IN FIVE COLLET CAPACITY SIZES

1 1/16", 1 3/8", 1 3/4", 2 1/4", 3 1/2"



STEP CHUCK TYPE
Takes Standard Spindle Nose Accessories As Used With Hardinge Precision Machines

LEVER TYPE

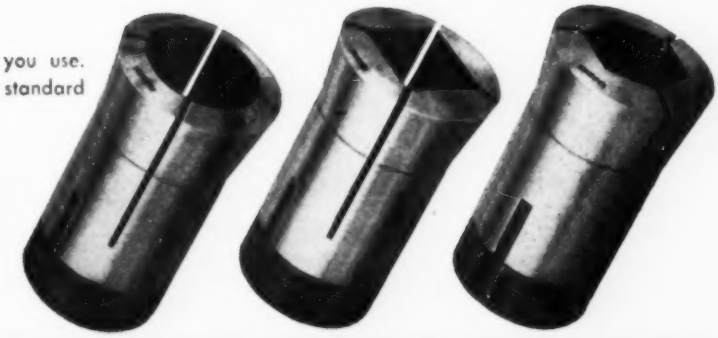
Ask Your Hardinge Representative or Local Distributor For Bulletin 88

HARDINGE
ELMIRA, N.Y.

HARDINGE Low Cost Steel Collets

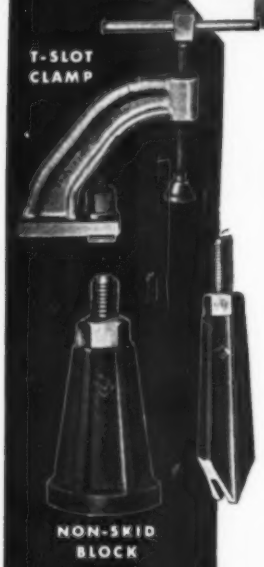
Maximum efficiency — Pay for only what you use. Records show that 82% of all sizes used are standard 16th sizes.

Buy only the sizes you use — Hardinge Collet stocks are available in Atlanta, Boston, Hartford, New York, Philadelphia, Rochester, Dayton, Detroit, Chicago, St. Louis, Minneapolis and Los Angeles. Also, Toronto and Montreal, Canada.



HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.

ARMSTRONG



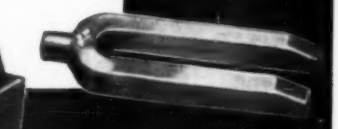
SET-UP AND HOLD-DOWN TOOLS

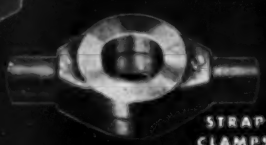
ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.

Write for Circular

Buy ARMSTRONG TOOLS from your Industrial Distributor



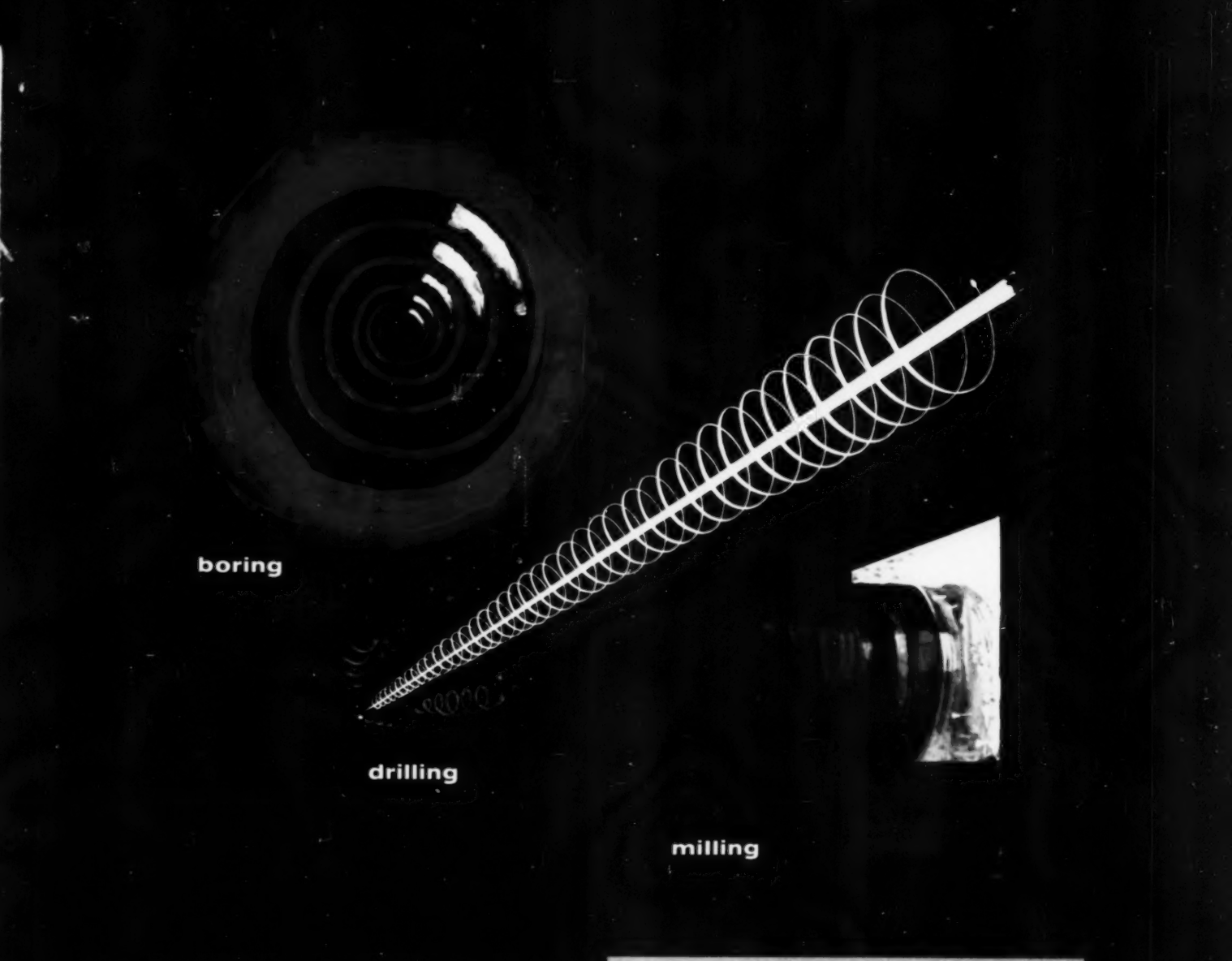


ARMSTRONG BROS. TOOL CO.

5215 W. Armstrong Avenue • Chicago 46, Illinois

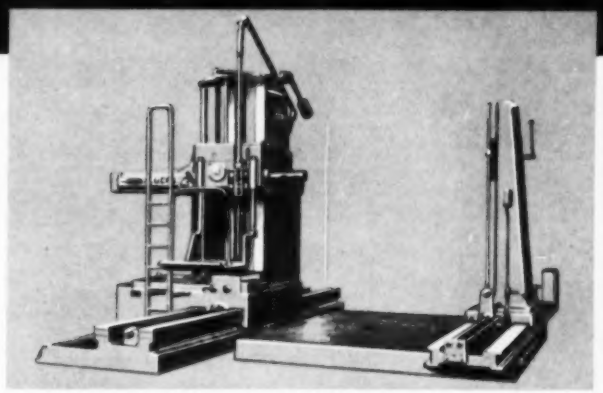
CIRCLE 181 READER SERVICE CARD

CIRCLE 182 READER SERVICE CARD ▶

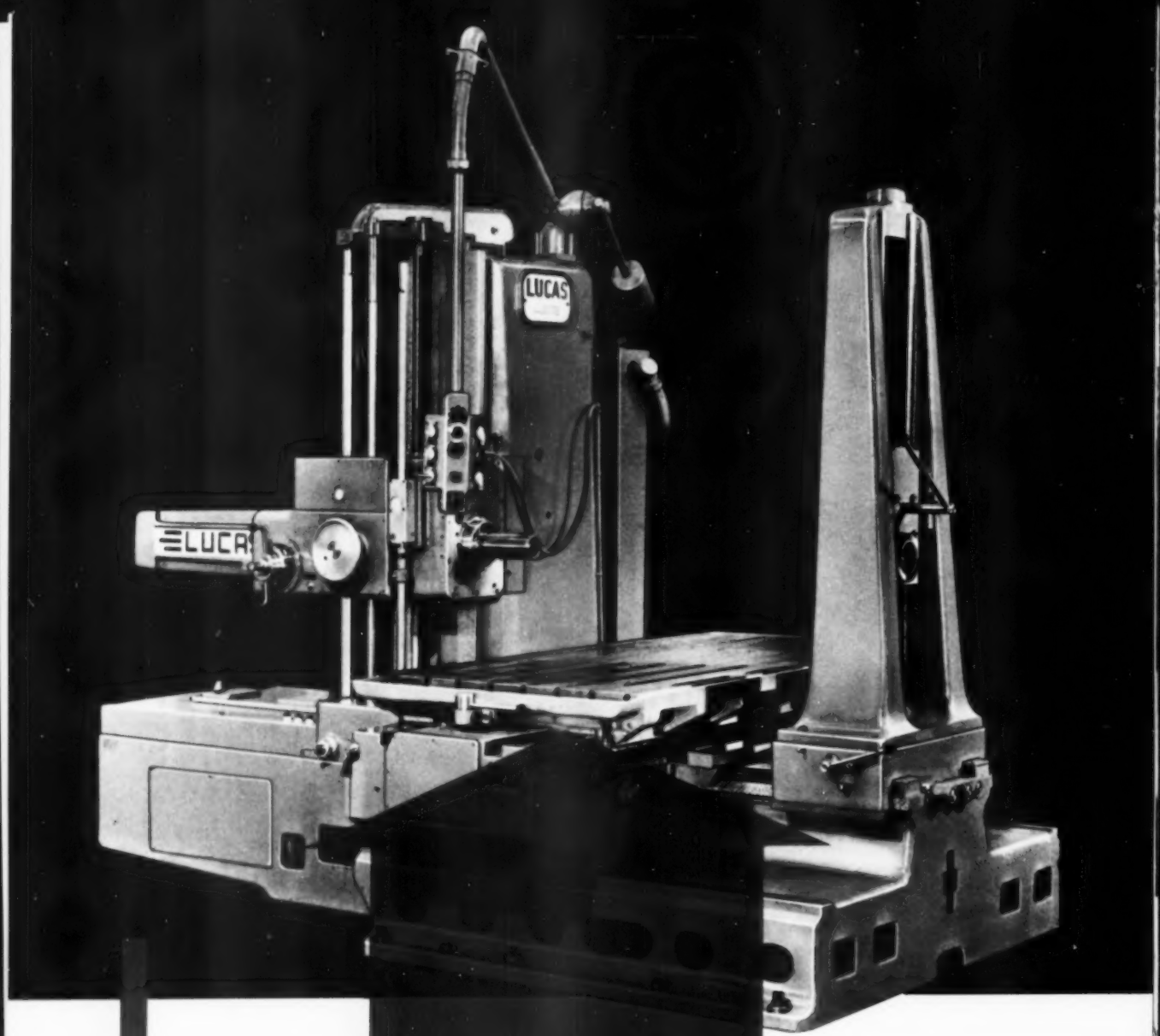


Floor type machines YES!

A complete line of floor-type, horizontal boring, drilling and milling machines in the 4" and 5" spindle diameter range . . . with all the features and controls available in other Lucas models. Many of these are to be found *only* in a Lucas. *Did you ever meet a man who regretted picking a Lucas?*



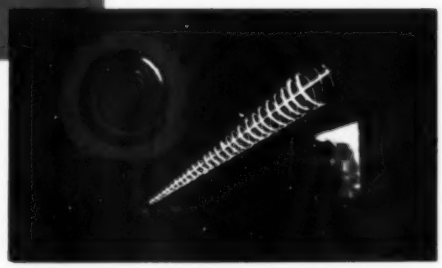
LUCAS
OF CLEVELAND



AIR LIFT*

to saddle and table

All Lucas components are fitted with the utmost precision. To insure lifetime accuracy, the saddle and table ride on lubricated compressed air . . . *ever so slightly above the surface of the ways.* Traverses, either feed or rapid, are silk-smooth and free of wear.



*Patent Pending

LUCAS
OF CLEVELAND

How Allison Wheels help you get

Quick, accurate cuts on almost any material or shape

• Abrasive cutting can give you *cleaner* cuts, *faster*—on almost any material from titanium to fire brick. But only when you use the proper cut-off wheel can you get the best results. That's where your ALLISON-CAMPBELL Field Engineer can help. Show him your cut-off problem, and he can select the ALLISON wheel that will cut your metals and other hard materials at speeds of just a few seconds per square inch—fine finish, without burn and with little or no burr—accuracy within close tolerances.

No matter what cut-off problem you have, chances are the right ALLISON wheel will do the job more quickly, less expensively, and more accurately than any other cut-off method. There's a complete selection of ALLISON wheels for every abrasive cutting application.

• • •

Resinoid bonded wheels are designed specifically for dry abrasive cutting machines. They cut at rates of 3 to 5 seconds per square inch, will cut 2" x 2" hardened steel on a standard chop stroke machine in 16 seconds.

Rubber bonded wheels are used primarily for wet cutting operations to obtain the finest quality cuts on all types of steel, alloys, titanium, glass, and plastics. Rubber bonded wheels are sometimes used for cutting tubing dry with minimum burr.

Masonry cutting blades, including reinforced types, are available for both wet and dry cutting of such materials as fire brick, concrete block, glazed tile, and transite. Use of the proper ALLISON wheel can reduce down-time for furnace repairs by speeding the installation of refractory brick.

Fiberglass reinforced wheels provide high cutting speeds while giving extra strength for many foundry cutting jobs. They're available in both resinoid and rubber bonded types, help prevent accidents and costly breakage.

GET THE COMPLETE STORY! Write for **Bulletin DH-214** for detailed information on abrasive cutting techniques, and the wide selection of ALLISON wheel specifications. ALLISON wheels are available 3" to 34" diameter, .006" to 3/16" thick. And remember—your ALLISON-CAMPBELL Field Engineer can give you specialized help. His know-how is your assurance of the efficient, accurate, and economical cutting you can expect from modern abrasive cutting techniques.

ACCO

ALLISON ABRASIVE CUTTING WHEELS

Allison-Campbell Division • American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.

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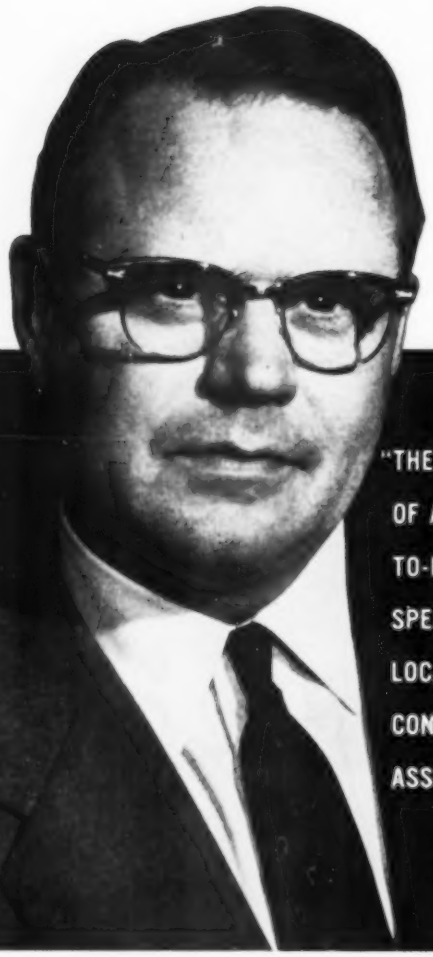
CIRCLE 184 READER SERVICE CARD

NEW FROM FAIR STREET • HOME OF THE JIGMIL

dia

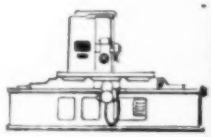
direct dial dimensioning system



"THE DIATROL SYSTEM OF AUTOMATIC POINT-TO-POINT POSITIONING SPEEDS UP SPINDLE LOCATION, SIMPLIFIES CONTROL AND ASSURES ACCURACY"

"Simply dial in the pre-selected coordinate dimensions, touch a button, the rest is automatic. The JIGMIL table and spindle head automatically position at the desired hole location in seconds. While the JIGMIL is machining, you can *pre-set* your next move. Developed by our own engineers, Diatrol adds to the inherent versatility and accuracy of the JIGMIL, further reducing human error as well as set-up and machine time. *Diatrol makes it possible to machine custom or small lot jobs at production rates.*"

C. R. DE VLIEG



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CIRCLE 186 READER SERVICE CARD ►

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for DeVlieg Spiramatic Jigmils

Simple! Accurate! Automatic! Diatrol is a transistorized electro-mechanical system, simple in design and simple to operate. All settings are made on direct reading dials; one dial for horizontal, the other for vertical dimensioning. Direct dialing of positive or negative dimensions is possible from any arbitrarily selected datum plane or zero point within the range of the system. Coordinate dimensions can be fed direct from the blue print, eliminating much of the mathematics formerly required for accurate jig boring. Measurement and positioning accuracies are controlled to one-ten-thousandth of an inch. Developed exclusively for the JIGMIL, Diatrol is now available for the complete range of JIGMIL precision boring and milling machines. For complete information, write or arrange a visit to Fair Street.

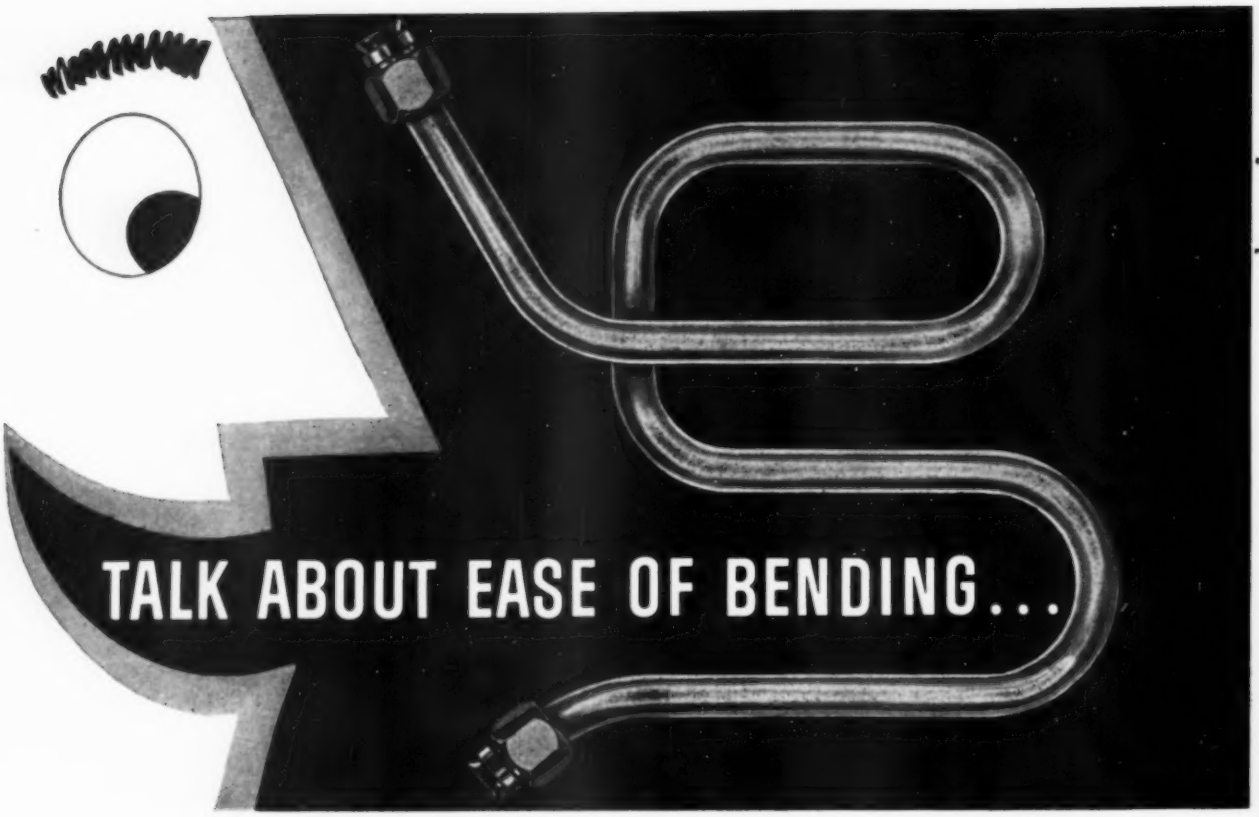
Rewarding revelations in precision await your visit to Fair Street

..... HOME OF THE JIGMIL

DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS



YOU SHOULD TRY ELECTRUNITE

The welded hydraulic fluid line tubing that offers lower initial cost... appreciable savings in downtime

The reason... uniformity! ELECTRUNITE Hydraulic Fluid Line Tubing is made from *high-grade, close-tolerance, flat-rolled* steel. Checked for defects as only flat rolled steel can be checked. Then: carefully formed, welded, annealed, cold-worked, and annealed again into a tube of unsurpassed uniformity... a tube that is easier to bend, easier to flare... a tube that meets or exceeds the normal life of tubing produced by any other method.

All this plus the fact that ELECTRUNITE costs *less* to buy (in all sizes shown in the *JIC Standards Book* and in an even wider range of sizes produced to our specification HL-1). Savings in downtime reflect still greater cost reductions. In the history of ELECTRUNITE Hydraulic Fluid Line Tubing, no failure resulting from longitudinal or transverse cracks has been reported.

The big switch is on! Join the hundreds of equipment and machinery builders and their maintenance departments now using millions of feet of ELECTRUNITE Hydraulic Fluid Line Tubing. Mail the coupon for complete information, including a copy of specifications.

MEETS ALL REQUIREMENTS OF THE JIC STANDARD!

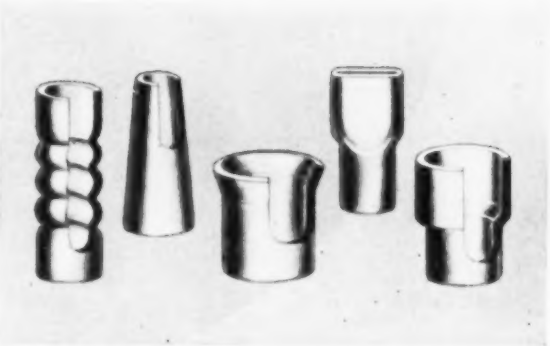
ELECTRUNITE® is available in all sizes shown in JIC Standards Book. Available in a wider range of sizes produced to our specification HL-1 (which meets all test requirements of the JIC standard).

REPUBLIC

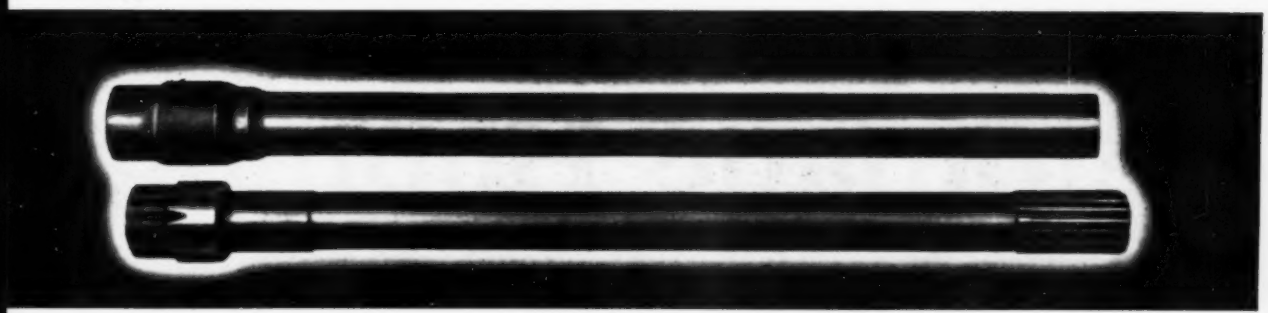
World's Widest Range of Standard Steels and

WORLD'S STRONGEST SHELVING —Republic Wedge-Lock® Steel Shelving—gives you all three essentials of good shelving: a post that will not buckle; a concealed, sway-proof joint; and a reinforced shelf that will not sag. Wedge-Lock's exclusive sway-proof joint actually becomes tighter as the load increases. Berger Division storage engineers can help you design an installation to fit your precise needs. Mail coupon for details.

SIMPLIFY TUBULAR PARTS PRODUCTION by standardizing on Republic ELECTRUNITE® Mechanical Tubing. Characterized by uniform wall thickness, concentricity, strength, and ductility, ELECTRUNITE is easily flanged, swaged, flattened, spun, fluted, configured ,rolled, upset, and otherwise changed in cross section to meet an endless variety of design requirements. For complete information send coupon.



REPUBLIC DIE-FORM BLANKS REDUCE COST of Ford Tractor power take-off countershafts. Because the Die-Form blank (above) closely approximates the completed part (below), scrap losses are negligible and machining is held to a minimum. Die-Form is a new method of cold forming hot rolled carbon, alloy, or stainless steel bars into multi-diameter blanks ready for final machining. Mail coupon for complete data.



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☐ ELECTRUNITE Hydraulic Fluid Line Tubing, including a copy of specifications ☐ Wedge-Lock Shelving
☐ ELECTRUNITE Mechanical Tubing ☐ Die-Form

Name_____ Title_____
Company_____
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City_____ Zone____ State_____

Automatic Hobbing

The Multicycle versions of the Barber-Colman No. 6-10 and No. 16-16 hobbing machines are designed for maximum production of mass-produced parts or those which are to be changed at relatively frequent intervals. Automatic cycling is combined with easy setup in these standard machines to which standard units are added. These Multicycle machines are not special machines, but the standard units can be used in various combinations to produce your job most efficiently. These machines can also be equipped for automatic loading when desired.

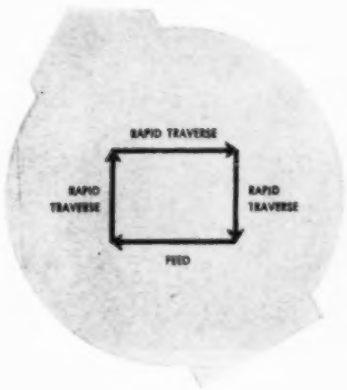
The machine is easily set up for automatic cycling. None of the Barber-Colman versatility is lost. Jobs can be changed as quickly and easily as ever. After the machine has been set up, the operator unloads, loads and presses the start button. Because of the automatic cycling, these machines are equally adaptable and efficient for the mass production of one specific part.

Reduce Approach Time

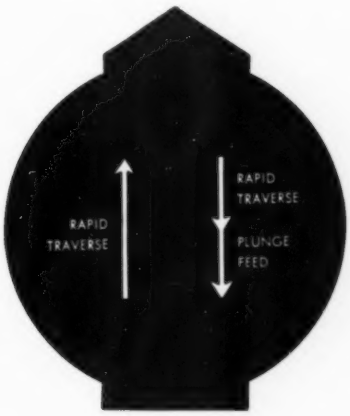
Approach time is often a high percentage of the total time required to produce a gear.

The plunge-approach cycle is designed to reduce approach time to a minimum. The horizontal feed is engaged at the start of the cycle so that the desired helix angle will be cut. The work feeds vertically into the hob until it reaches full depth. The vertical feed changes constantly from a fast feed at the beginning of

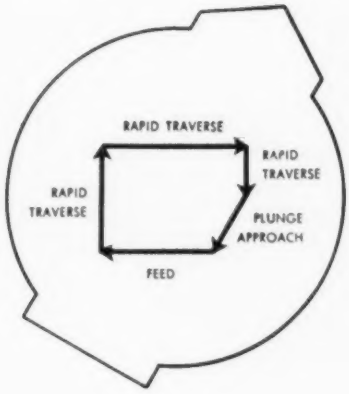
Any one of these automatic cycles can be selected simply by turning a switch on the control panel.



SQUARE CYCLE – automatic version of the conventional hobbing cycle.



PLUNGE CYCLE – automatic vertical feed for cutting worm gears.



PLUNGE-APPROACH CYCLE – combination of "plunge" and "square"

. . . with typical Barber-Colman versatility

the cut to a slow feed as the hob reaches full depth. The vertical feed and rapid traverse are controlled by the vertical feed cam. The rate of vertical feed is infinitely variable.

The plunge-approach cycle allows the use of larger hobs with more flutes or threads without an increase in approach time. More flutes can be used for greater accuracy and higher production, and more threads will normally result in an increase in production. This cycle can be used advantageously for cutting blind worms or blind gears.

Square and Plunge Cycles

These machines can be set up for square cycle with conventional or climb cut in either direction, and for plunge cycle for worm gears. Cycling is completely automatic for both arrangements.

Get Multicycle Production Estimate

Send us your gear prints for a production estimate on a Multicycle machine. Call your nearest Barber-Colman field office or the factory, WO 8-6833.

Barber-Colman Company

BARBER COLMAN

91 Loomis Street, Rockford, Illinois

x=y5+34
.447
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Your SIMONDS industrial supply distributor goes back to school *to help you!*

For 12 years now, salesmen and sales managers of Industrial Supply Distributors from all parts of the country have been attending Simonds "Little Red Schoolhouse" . . . taking courses to learn "first hand" how Simonds saws, knives, die steel, files, etc., are made, how they should be used and why they give so much better on-the-job results.

To these men, Simonds is more than just another "line." They *know* the difference Simonds steel and workmanship make in the performance you can count on from every Simonds product. They know how to match the right tool to your needs and save you important dollars.

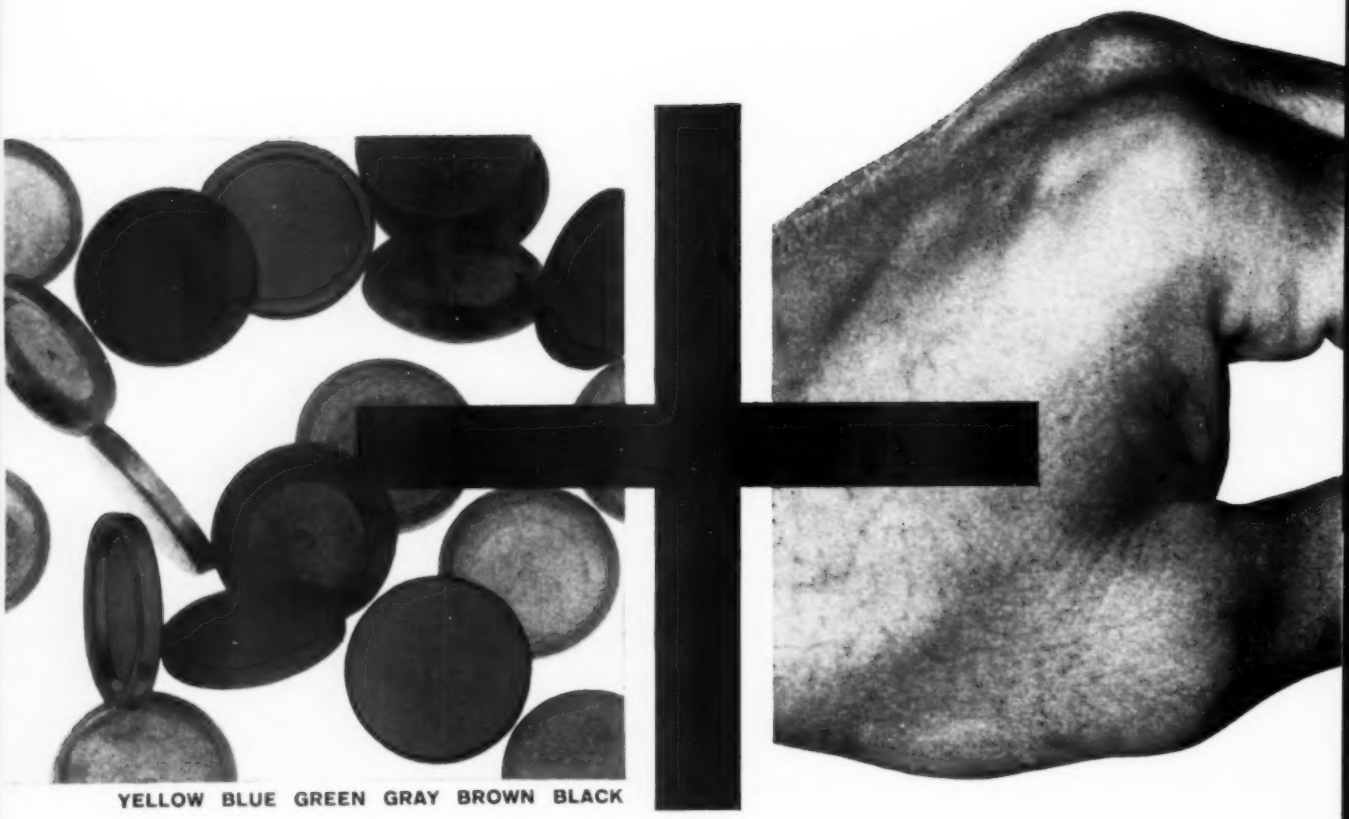
They're set up to give you prompt delivery too, for regular or emergency needs, from *their* stocks backed up by Simonds branch warehouse stocks. They're genuinely interested in giving you real service . . . are "Johnny on the spot" when you need them.

"Going back to school" helps these men help you . . . sets up a supply "team" that saves you time, simplifies your purchasing, keeps your cutting tool efficiency high and your costs low.

For Fast Service from Complete Stocks Call your SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

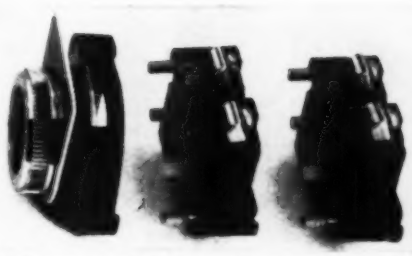


YELLOW BLUE GREEN GRAY BROWN BLACK

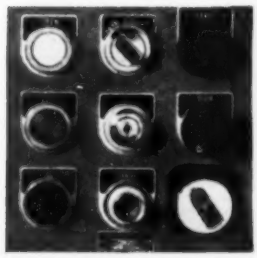
CIRCLE 193 READER SERVICE CARD

WESTINGHOUSE FLUSH PUSHBUTTON

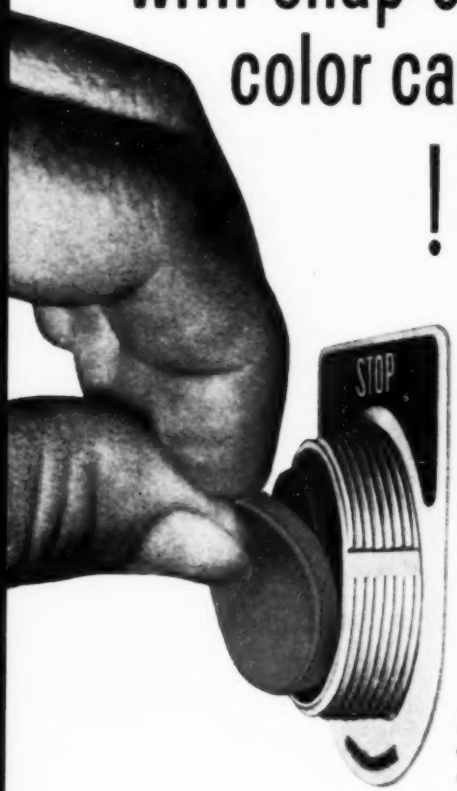
puts the finger on color coding with snap-on color caps !



Shallow contact blocks stack for multiple control circuits. Angled terminals are easy to get at with a screwdriver, even when blocks are stacked.



Available in a full range of operator designs.



HERE'S PRACTICAL PUSHBUTTON COLOR CODING–the economical Westinghouse way. Snap-on color caps let you change colors *without changing buttons.* Simply remove the clamp ring and color caps snap off easily and can be replaced in a matter of seconds.

Simplified color coding is but one of the many pluses for new Westinghouse flush pushbuttons. Thin operator and shallow contact blocks make this pushbutton *thinnest overall.* Contact blocks stack for control of multiple operations, another space-saving feature.

Flush pushbuttons are oiltite, of course. And they meet exacting machine tool and control panel requirements. Available in a full range of operator designs.

Regardless of your pushbutton requirements, order with confidence from industry's most extensive line. Contact your nearby Westinghouse sales office or distributor, or write: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

J-30304

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

CIRCLE 194 READER SERVICE CARD

JONES & LAMSON TURRET LATHES

the man who needs a new machine tool is already paying for it

Single point threading to a finish of 15-20 RMS is completely automatic–and fast

The I. D. of these large cap-nuts is approximately $5\frac{1}{4}$". The material is High Chrome Nickel Steel, Rockwell C 30–32. The thread is 8 pitch, $5\frac{1}{2}$" long, *and tapered .005" per inch.*

It's a tough job to make time on, but a J & L Turret Lathe equipped with an Auto-Threader, does the threading in 5 minutes!

Here's how: The part is faced and a rectifying bore is made; in the same chucking, threading is completed in 16 automatically-controlled passes, with a graduated cutting depth for each pass. *Pitch diameter is held to .002",* and finish is 15–20 RMS on the flanks.

On the old machine, milling the thread alone took 75 minutes. With this new setup, the entire operation — including loading, facing, boring, threading and unloading — is only 15 minutes.

Jones & Lamson Turret Lathes are available with: Completely automatic controls; 45°, 60°, and 180° Tracers; taper attachments, and a variety of other tooling complements, all designed to increase productivity.

Write for detailed information, Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

POSITIVE DUPLICATION—EVERY TIME!

To "true" vertical lines, today's home builders depend on the familiar plumb—just as pyramid-building Egyptians did 5,000 years ago. The plumb's action and accuracy are always the same.

You can depend on the action and accuracy of these CINCINNATI (PD)° Centertype GRINDING WHEELS (and *all* CINCINNATI WHEELS) . . . because you get Positive Duplication, time after time after time.

YOU GET CONTROLLED QUALITY

Thirty-six separate quality control steps—in the unique (PD) process—result in wheels of unsurpassed uniformity.

Everything that goes into a Cincinnati Wheel, every operation from formula blend to final inspection, is governed by a checking procedure that never varies.

You can reorder a CINCINNATI (PD) WHEEL knowing without question that it will act and grind exactly like the original. Whatever shape, grade and size you specify . . . centertype, centerless, internal, surface, toolroom or snagging wheel . . . you get Positive Duplication—Every Time!

CUT COSTS . . . CALL CINCINNATI

Our factory representatives are trained specialists, experienced in grinding job set-ups and operations. Their skills and experience are at your service. Just call your CINCINNATI (PD) GRINDING WHEEL distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

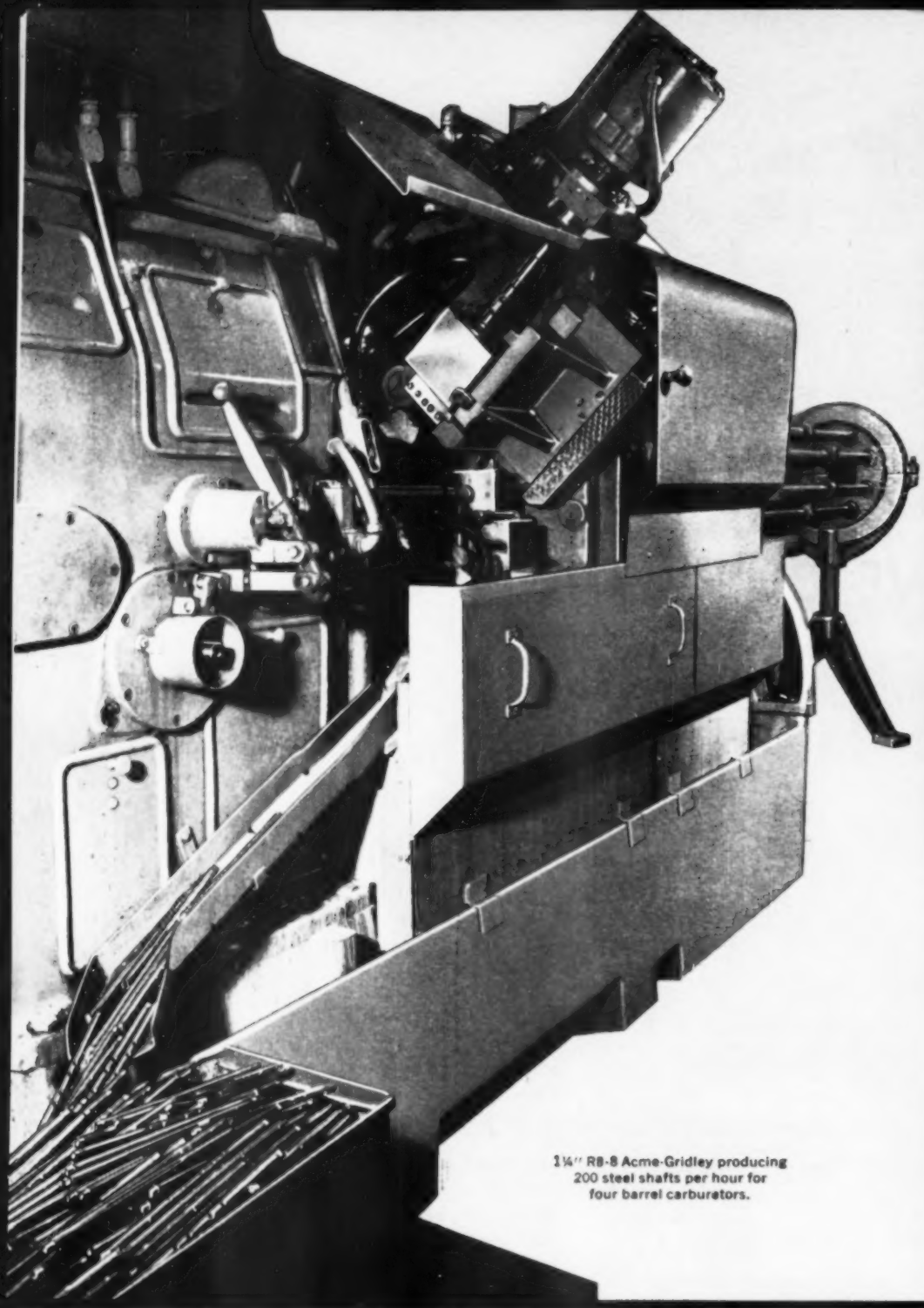
CINCINNATI
GRINDING WHEELS

°Trade Mark Reg. U. S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

CIRCLE 196 READER SERVICE CARD

CIRCLE 197 READER SERVICE CARD ►



1¼" RB-8 Acme-Gridley producing 200 steel shafts per hour for four barrel carburetors.

NATIONAL ACME'S "ZONE OF RESPONSIBILITY"

INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Carter Carburetor . . . an "every day" job for Acme-Gridleys.

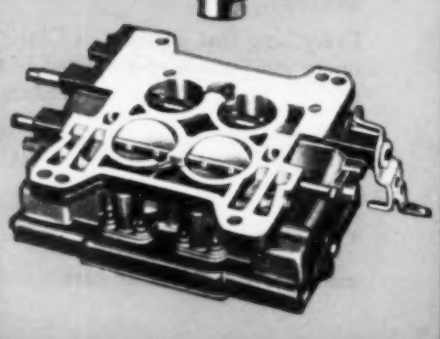
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.



Versatile Acme-Gridley produces

EIGHT DIFFERENT PARTS

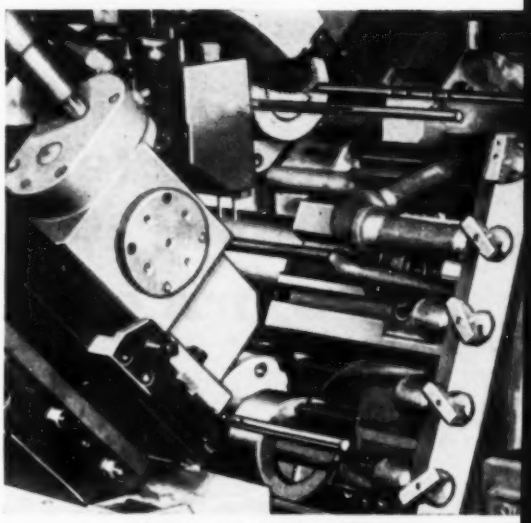
With Only Minor Changes in Tooling Setup

***For Carter Carburetor** division of ACF Industries, Inc.*

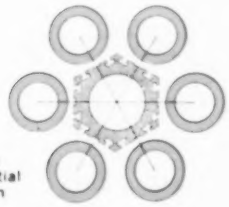
Here's machine tool versatility at its best . . . versatility that provides documented cost savings for Carter Carburetor year in and year out. Machine investment and cost-per-piece are greatly reduced. Illustrated is but one example.

The spindles of a standard $1\frac{1}{4}$" RB-8 spindle Acme-Gridley bar automatic were locked against rotation with a simple spindle locking device. Each spindle functioned as a work holder when the machine indexed from position to position. The inherent accuracy of Acme-Gridleys assured precise alignment of the work with the standard and special attachments . . . whether it's the first or last piece in the run. When spindle rotation is desired, the locking device is simply removed and replaced by the spindle drive gear.

Check the industry's most modern approach to tangible cost reduction. Call, write or wire today!



Close-up of tooling zone showing milling of slot in 4th position.



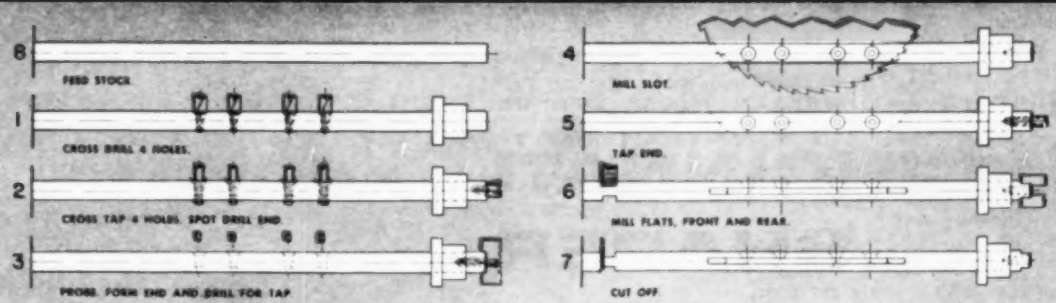
Pioneer in Circumferential Automation

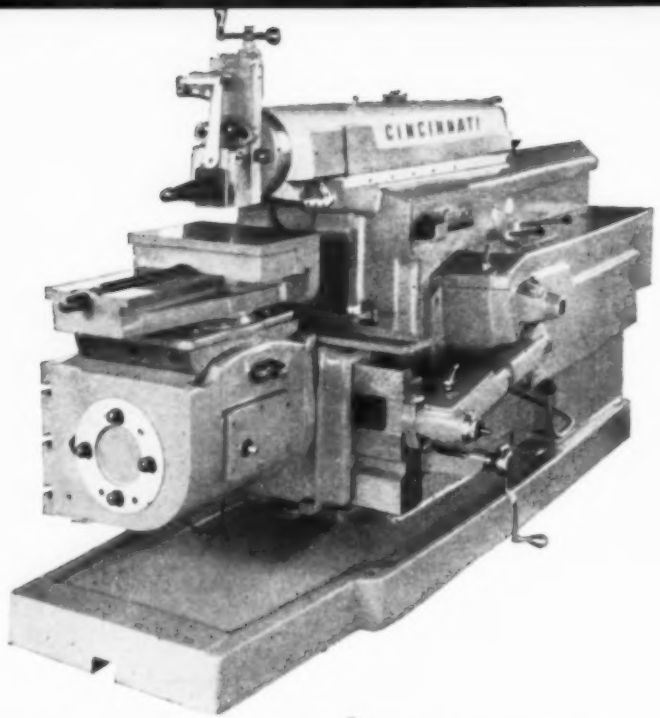
National Acme

THE NATIONAL ACME COMPANY
171 E 131st STREET
CLEVELAND 8, OHIO

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

16 Operations





Cincinnati® Shaper standard features: extra savings at no extra cost

Cincinnati Shapers give you so many money-saving features per dollar invested that they can be the most profitable equipment in your shop.

1. This 2" cut, .030" feed on a 24" H. D. Cincinnati® Rigid Shaper, demonstrates the ability of the 50 psi automatic lubrication system to maintain oil films under heavy loads.

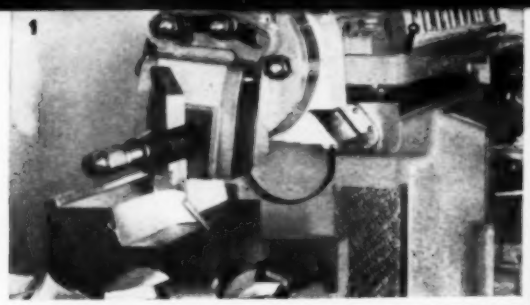
2. Brushless electromagnetic brake and clutch insure fast, easy operation. No adjustment is required.

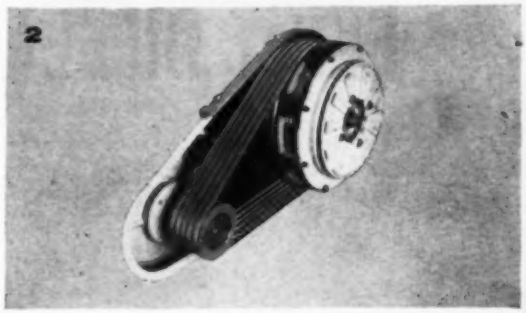
3. Both vertical and horizontal rapid traverse are standard Cincinnati features which substantially reduce setup and cutting time.

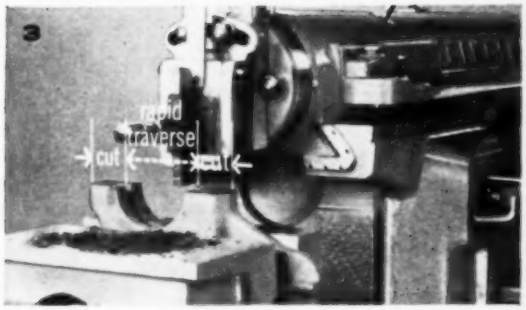
4. Extended ramway bearings increase ram support and minimize wear. Full table clearance to the column gets work closer to the column, minimizes overhang.

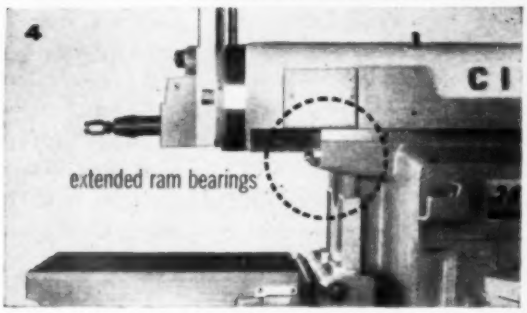
5. The vee ramways are integrally cast with the column. Ramway rigidity is increased by eliminating joints. Full length tapered gib provides for easy adjustment, maintains accuracy.

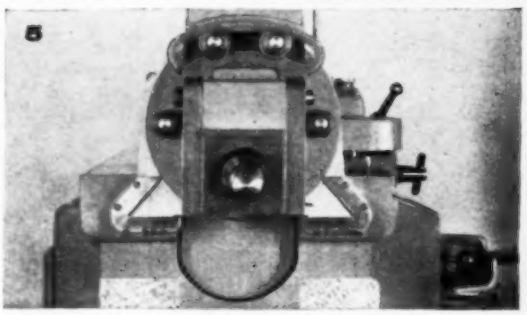
Write Dept. A for Catalog N-7.











Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

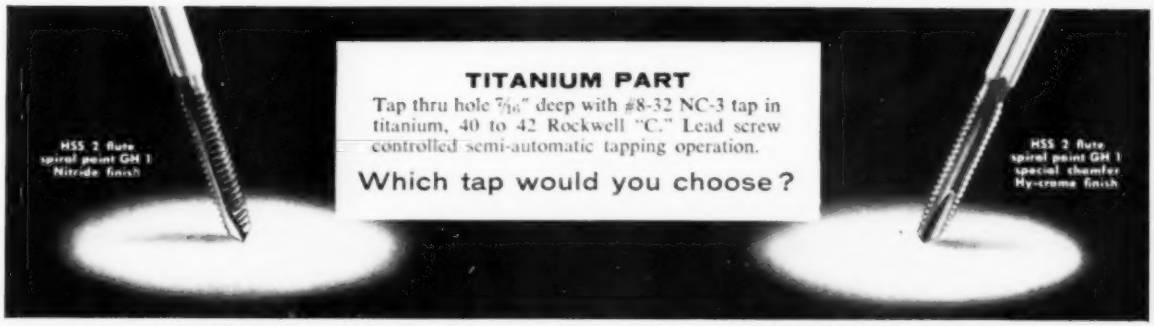
Cincinnati 11, Ohio

◄ CIRCLE 198 READER SERVICE CARD

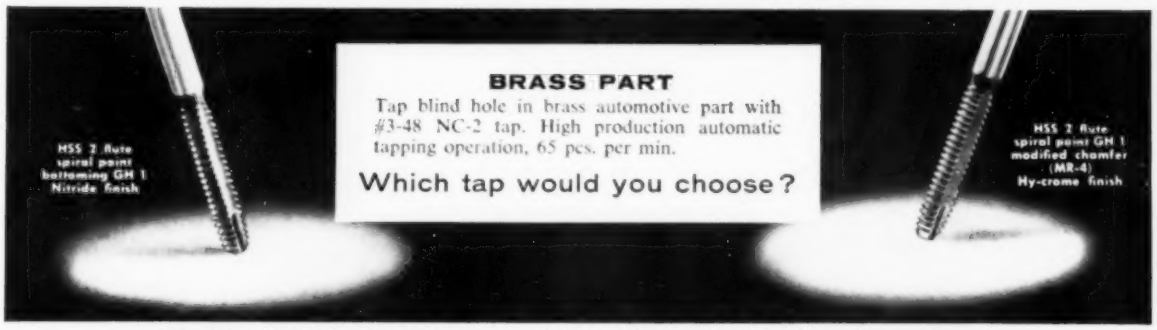
CIRCLE 199 READER SERVICE CARD

Take the **HY-PRO "TAP-nology" TEST**

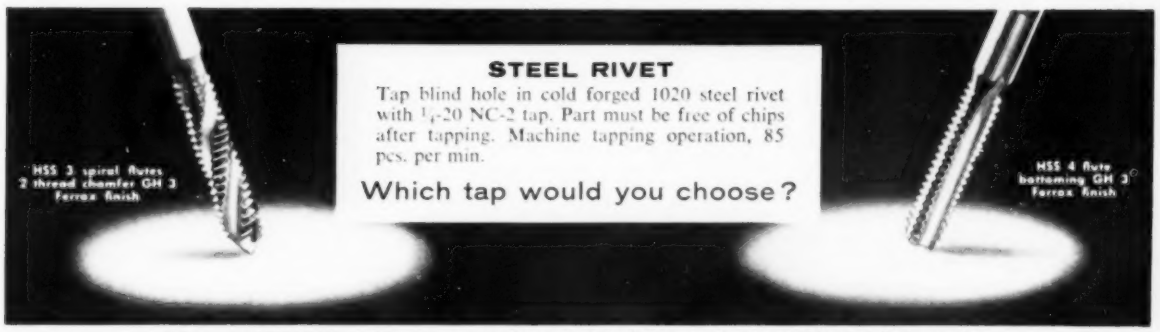
and see how you score in selection for savings


HSS 2 flute spiral point GH 1 Nitride finish
TITANIUM PART
Tap thru hole 7/16" deep with #8-32 NC-3 tap in titanium, 40 to 42 Rockwell "C." Lead screw controlled semi-automatic tapping operation.
Which tap would you choose?
HSS 2 flute spiral point GH 1 special chamfer Hy-crome finish

The HY-PRO tap designed with special chamfer and Hy-crome finish (right) produced 12.3 times the number of holes per tap obtained with the standard tap with nitride finish.


HSS 2 flute spiral point bottoming GH 1 Nitride finish
BRASS PART
Tap blind hole in brass automotive part with #3-48 NC-2 tap. High production automatic tapping operation, 65 pcs. per min.
Which tap would you choose?
HSS 2 flute spiral point GH 1 modified chamfer (MR-4) Hy-crome finish

The HY-PRO MR-4 tap with Hy-crome finish (right) produced 8.2 times the number of holes per tap as obtained with the bottoming Nitride finish tap.


HSS 3 spiral flutes 2 thread chamfer GH 3 Ferrox finish
STEEL RIVET
Tap blind hole in cold forged 1020 steel rivet with 1/4-20 NC-2 tap. Part must be free of chips after tapping. Machine tapping operation, 85 pcs. per min.
Which tap would you choose?
HSS 4 flute bottoming GH 3 Ferrox finish

The new HY-PRO "CR" Series, #307 tap 3 Spiral Flutes (left) produced 4.2 times the number of holes per tap obtained with the 4 flute tap.

Call your local HY-PRO DISTRIBUTOR for standard taps FROM STOCK

Did you pick the right taps? If not, just remember similar errors in selection are common among tap users who buy taps by "habit" instead of *comparative performance*.

Today, tap selection is more difficult than ever, with so many new metals, alloys and plastics in industrial use. So be sure that your "TAP-nology" is up to date. Consult your HY-PRO tap engineering specialist. It costs nothing . . . and these examples show how much it can pay off for you. Write: Dept. B.

HY-PRO TOOL COMPANY

NEW BEDFORD, MASS., U. S. A.

HY-PRO

CIRCLE 200 READER SERVICE CARD

CIRCLE 201 READER SERVICE CARD ►

Doubles production of splined shafts per hob shift with

GULF MAKES THINGS

"Until recently, we were using a soluble oil in the hobbing of flutes on the rifle bars for our Cleveland Le Roi drills. Then, when we installed a new gear hobber, we switched to Gulfcut 21C, a sulfurized mineral cutting oil. Since then, using the same type of hob as before, we have doubled hob life on this job and now machine twice as many rifle bars between grinds."

That's the word from Gordon Moffat, Factory Superintendent at the Cleveland Rock Drill Plant of Westinghouse Air Brake Company's Le Roi Division. This plant produces many varieties and sizes of 3 basic types of drill—the hand sinker, stoper and air leg.

"With the previous cutting oil," reports Mr. Moffat, "we were getting only 7 finished spline shafts from each hob shift, between grinds. Feed and speed were .0135 ipr and 154 rpm respectively. With Gulfcut 21C, our feed is now .018 ipr with a speed of 200 rpm. We now turn out 12-14 pieces between grinds, double our previous production. With hobs at $100 each, this amounts to quite a saving in tool costs.

"We're also getting better finishes with the help of Gulfcut 21C, and we find it much easier to stay within our specified tolerances."

Why does Cleveland Rock Drill get such good results with Gulfcut 21C? Because it provides greater sulfur activity over a wide range of machining operations.

The "rock room" where Cleveland Le Roi drills are given rugged tests before shipment. At left, Gordon Moffat, Factory Superintendent at Cleveland Rock Drill Plant. Right, T. F. Irving, Gulf Sales Representative.

Gulfcut oil . . .

RUN BETTER!

Gulfcut 21C is one of the high performance cutting oils in the Gulfcut line. See how Gulfcut can help improve your machining practices. Call your Gulf office, or use coupon for more information.

New 100-page manual gives full information on selection and usage of cutting oils. Mail coupon for your free copy of "Metal Machining with Cutting Fluids."

GULF

GULF OIL CORPORATION
Dept. DM, Gulf Bldg., Pittsburgh 30, Pa.

☐ Send new 100-page cutting oil manual.
☐ Send Gulfcut bulletins.

Name _____

Title _____

Company _____

Address _____

City _____ Zone ____ State _____

SP 9627

DRILLING HIGH TEMPERATURE ALLOYS WITH THE "BUFFALO" RPMSTER

In 1953, this "Buffalo" RPMster was installed in General Electric Company Jet Engine Department's Metal Working Laboratory. Since that time it has operated for thousands of hours, drilling high temperature alloys such as A-286, U-500, Rene-41, M-252, L-605, X-40, chrom-alloy and many other difficult materials.

In conjunction with dynamometers to record drill thrust and torque, many drilling problems have been solved. The "Buffalo" RPMster was ideally suited to this job because of its instantly available range of speeds from 90 to 3000 RPM and rigid construction. While General Electric uses the drill for testing purposes, new improvements make the "Buffalo" RPMster even more desirable as a production or special application drilling machine. A new torque controlled power feed prevents damage to machine and tool being used and capacities up to 2" are now offered. Of special interest to companies drilling super-hard materials is the modified RPMster supplied with balanced hollow spindle, forced coolant system having a pump with a capacity to 100 psi, special splash guards and rubber-flex collet chuck. This machine is designed to operate with the new hollow core "cold point" drill, and diamond impregnated bits. "Buffalo" hollow spindle drills are available for speeds up to 10,000 RPM.

For further information on the "Buffalo" Variable Speed RPMster, contact your machine tool dealer or write direct for details.

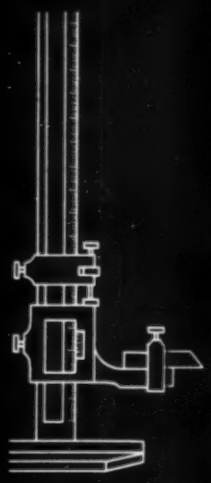
BUFFALO FORGE COMPANY ESTABLISHED 1877 "Buffalo" MEMBER NMTBA **509 BROADWAY • BUFFALO, N. Y.**

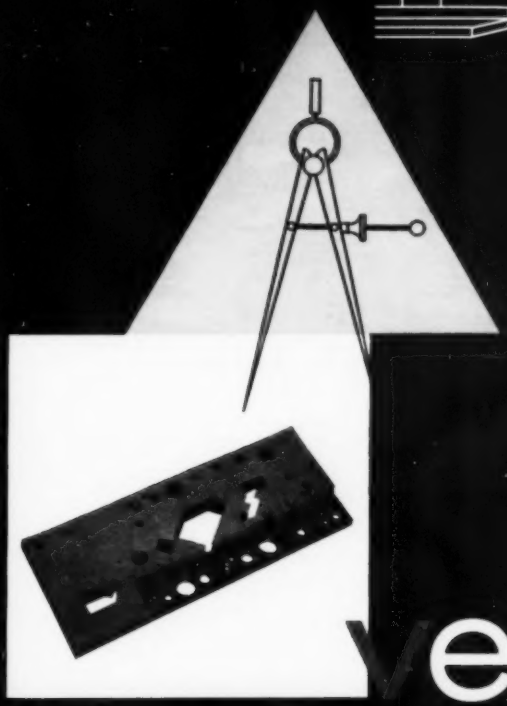
CANADIAN BLOWER & FORGE CO., LTD., KITCHENER, ONTARIO

DRILLING • PUNCHING • SHEARING • BENDING

◄ CIRCLE 202 READER SERVICE CARD

CIRCLE 203 READER SERVICE CARD





and now...

MEL-TROL®

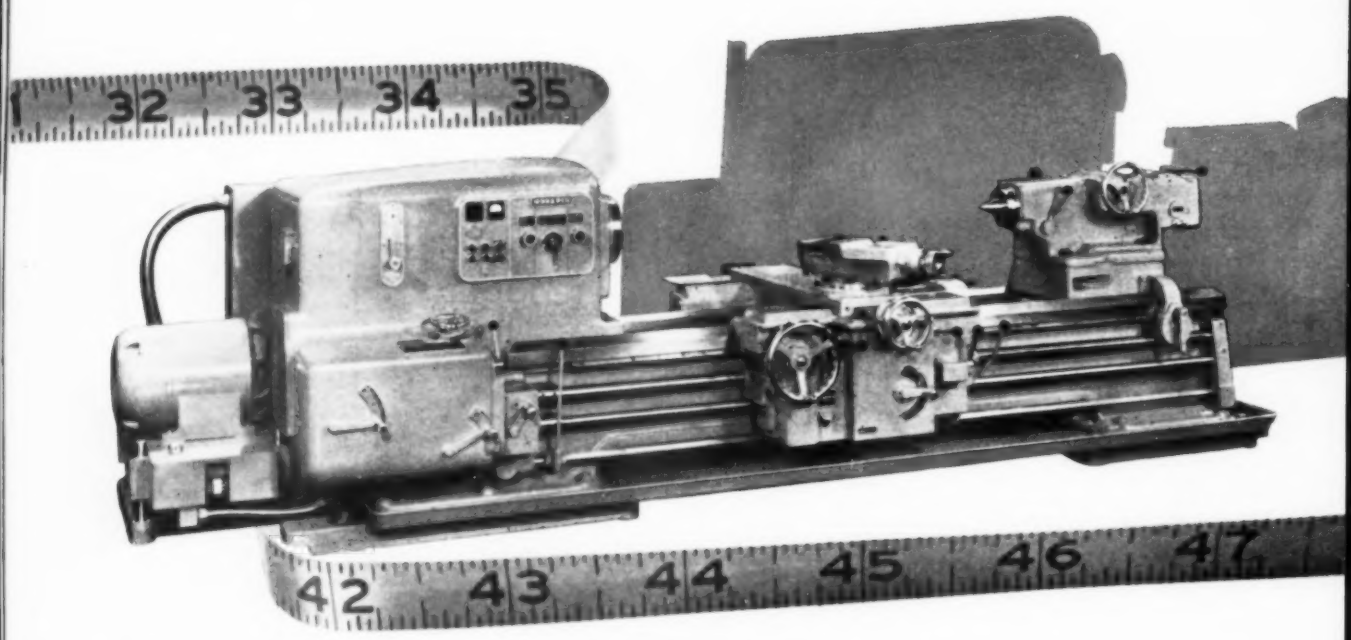
Vega (A.I.S.I. Type A6)

gives you deeper hardening, less sensitivity to overheating, greater protection against size change and distortion, greater toughness than competitive air-hardening steels such as A4. And now, produced to MEL-TROL standards, Vega gives you the greatest plus of all—maximum uniformity from surface to core, end to end, lot to lot. Vega combines the machining properties and simplicity of low temperature heat treatment of many oil-hardening grades with safety in hardening of an air-hardening steel. Get immediate delivery from your local Carpenter SERVICE-CENTER.

the *Carpenter* Steel Company, Reading, Pa.

Only Another Monarch Series 90 can measure up to

This Lathe's productivity



Big work requires more than just a big lathe

Massive machine components and the necessary swing capacity don't fill the complete bill by far. The basic consideration is almost always greater production, therefore lowered costs.

You get this in the Monarch Series 90 Heavy Duty Dyna-Shift—an ultra-modern machine which will remove more metal at any speed than is possible on any other heavy duty lathes. Maximum production is assured because here is a machine that can be kept under full load during the entire cutting cycle. Major contributing factors design-wise are more machine output per unit of power input, less operator effort, reduced maintenance, ease of supervision. The Series 90 meets all these requirements as does no other heavy duty lathe —and the points discussed in this ad tell you why.

Production increases of 25% or more along with a similar improvement in tool life are a common experience for Series 90 users. There's the pay-off when you invest in the best—the cheapest in the long run. The Series 90 is available in three models ranging from 40″ to 48″ clearance diameter and 25″ to 36″ swing over the cross slide. Write for Booklet 1601.

THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO.

ELECTRICALS PLACED RIGHT

1. External main drive motor mounting and external electrical control mounting (either NEMA or JIC) for quick accessibility.

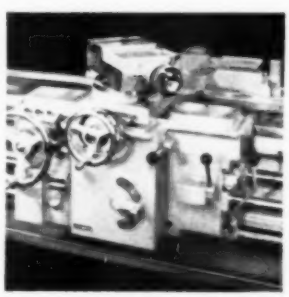
2. Motor mounted on hydraulic system sump also supplies power for hydraulic pump.

CONTROL CENTERED AT THE APRON

1. Electrically actuated power traverse, left or right, for fast carriage movement. Jogging for critical positioning may be accomplished any time desired.

2. Positive, cam controlled feed frictions. Application is such that machine never loses its chip under the heaviest of cuts.

3. All controls located to permit operation from a stand-up position—no stooping or stretching necessary.



CIRCLE 205 READER SERVICE CARD

CIRCLE 206 READER SERVICE CARD ►

HEADSTOCK WITH A BRAIN

1. 36 speeds—range 6 to 750 R.P.M.—ratio 1 to 125. Standard range low enough, high enough and with plenty of speeds in between to provide reasonably constant surface cutting speed on most work.

2. Operator works in terms of surface cutting speed. Machine automatically figures correct R.P.M. and sets up shift. Operator sets two dials—one for work diameter, the other for desired surface speed. A speed indicator always shows the R.P.M. in engagement.

3. Flip of a lever gives free spindle in a jiffy. And there is a generous 4 3/16" hole through the spindle.

4. Hydraulic brake and clutch are self-adjusting for wear. Being under automatic machine control regardless of load, operator needs not supply power for engagement.

MACHINE CONTROL—EASY DOES IT

1. Series 90 controlled by a three-position lever at the apron. A duplicate lever close to the headstock is provided for setup purposes. With this lever, work rotation may be started or stopped and jogging may be accomplished.

2. Shifting, an operation performed many times each day, is at fingertouch ease and speed. Hydraulic power does the work of clutching, braking, gear shifting and jogging.

COMPLETE AUTOMATIC LUBRICATION

1. Headstock, end gearing and gear box served by single system of the filtered, combination mist-splash type.

2. Apron lubrication system of the circuited, metered and filtered type also provides oil to carriage guide ways and cross slide bearings. There is ample lubrication during both power and manual longitudinal and cross feed.

3. Separate tailstock lubrication system.

PROTECTED GEAR BOX AND END GEARING

1. Both the gear box and end gearing are totally enclosed. Lubrication is kept in, dirt kept out, original accuracy maintained.

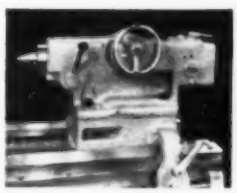
TOPS IN SAFETY INTERLOCKS

1. When machine is started, the brake engages automatically, preventing spindle rotation regardless of main control lever position.

2. No speed shift can be made with spindle rotating. More than anything else this preserves the original accuracy of headstock gearing.

3. Leadscrew and feed rod cannot be engaged simultaneously.

TAILSTOCK AHEAD OF THEM ALL



1. Either single speed or two speed range type available with dead or anti-friction center spindle. Sufficient mass, rigidity and spindle size (7" diameter) to support the heaviest of cuts.

2. Work piece expansion, due to heat, absorbed by heavy duty springs in the tailstock.

3. Handwheel located at front for convenience of operator when changing work pieces.

ADDED EQUIPMENT FOR ADDED PRODUCTION

1. Additional equipment in considerable variety is available for the Series 90 line. Consider, by all means, the advantages of the "Air-Gage Tracer," a means by which thousands of users have reduced costs substantially.

2. Ask for descriptive Booklet 1601 which not only describes the basic machine but the commonly used items of additional equipment and includes full specifications.

Monarch

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

INSTANT SUPERVISION

1. At a glance, supervisor may check (a) work diameter setting, (b) S. F. P. M. setting and (c) H. P. consumption. This makes it possible easily and quickly for him to assure full productiveness of the machine and the operator at all times.

THE BED—FLAME HARDENED, ROCK-SOLID

1. All four bed ways flame hardened and precision ground to keep them factory-fresh for years to come.

2. Triangular bridge type girth construction throughout entire center section provides stability needed for heavy duty work.

3. Longer machines equipped with traveling rod supports which are automatically picked up and dropped off by apron.

4. Dual pump coolant system, with electrical control on apron convenient to operator, guarantees ample coolant exactly where and when it is wanted without long and unsightly hose strung over machine.

A PRODUCT OF SKILL

BUTTERFIELD
100%
INSPECTED
TOOLS

the complete line

Expertly-made Butterfield end mills, reamers, drills, taps, dies, counterbores, cutters, hobs and carbide tools are quickly available wherever you are located. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **Call your Butterfield Distributor.**

BUTTERFIELD

BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

"What you don't know about grinding wheels makes an important difference"

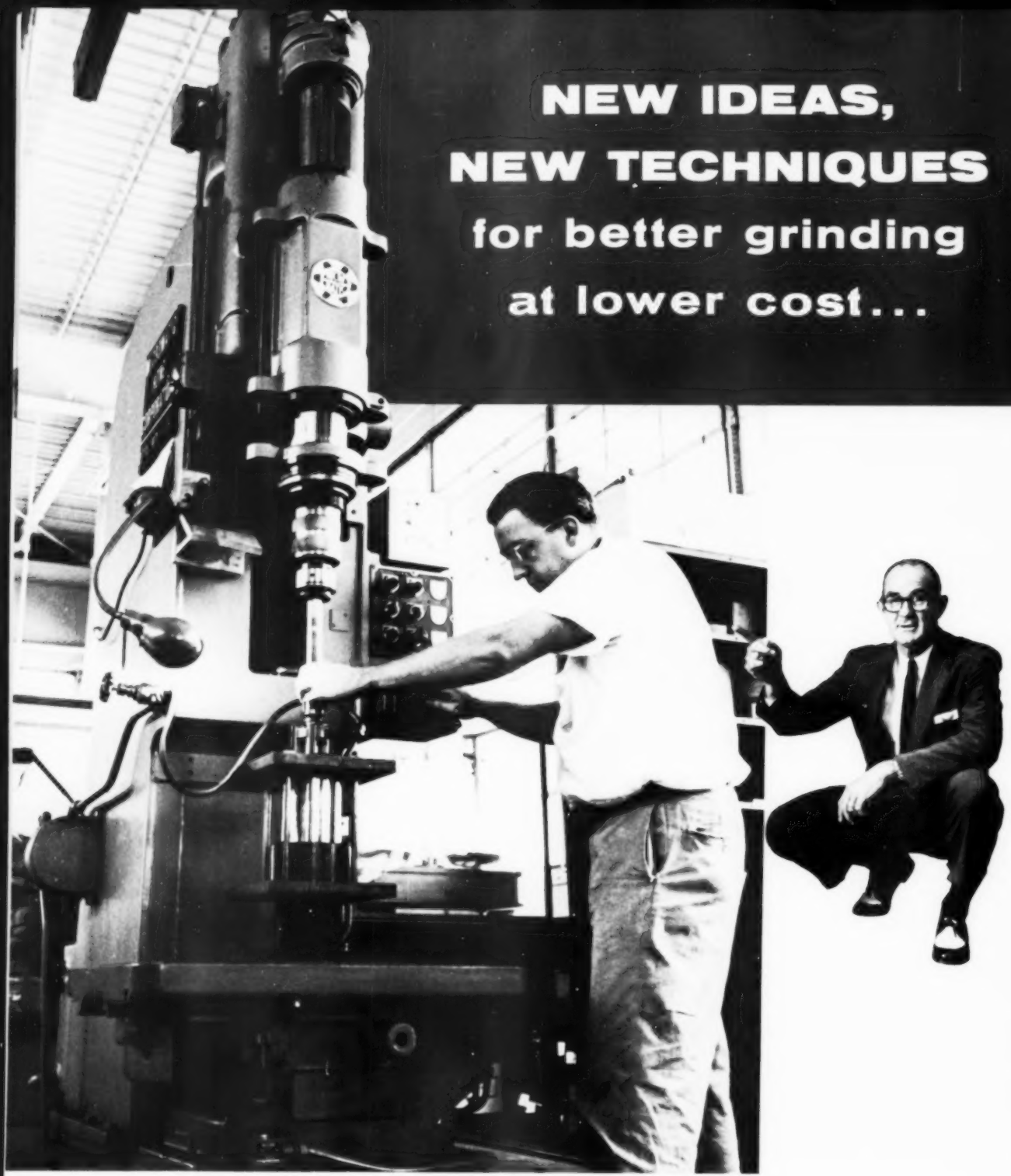
Elden L. Auker, Marketing V. P. of Bay State Abrasives, is a man who knows the industry through years of experience both in working in the field with Bay State customers and from close association with the research and development programs at Bay State's manufacturing headquarters in Westboro, Mass.

"It's a sad but proven fact that all grinding wheels are *not* the same... even when they *look* the same and, in many cases, even when they have the same general specifications.

"The fact that many of our wheels are safer, faster-cutting and more efficient than their competitors is a tribute to our research and development people... who have led the world in such important abrasive developments as REINFORCED RAISED HUB DISC-WHEELS, GRIT-CLOTH, HIGH SPEED SNAGGING WHEELS, DURACUT...and whose latest developments promise to give even greater reality and meaning to our long-established 'Wheels of Progress' trademark.

"To show you specifically what I'm talking about, let's take a look at some of the current research and product quality projects under way at Westboro..."

NEW IDEAS, NEW TECHNIQUES for better grinding at lower cost...



"A completely new approach to the manufacture of honing stones is in the works. It starts with a unique, atmosphere-controlled kiln which promises more perfect uniformity of honing stone performance than has ever been possible before. The process winds up with tests under actual production conditions, as shown above. Technician Arthur Taylor is running a vertical honing machine which is one of the very few such test machines — and may well be the only one — devoted solely to research use by an abrasive manufacturer. Tests run on this machine show up the smallest weaknesses and inconsistencies of texture, stone-hardness, etc., and these are weeded out so that production stones are uniform in every respect."

"Increased automation of vitrified wheel production helps speed up customers' orders by eliminating many time-consuming steps. Conveyors deliver mix to the press line where each press has its own, automatic drying oven. Here, Factory Superintendent Richard Thompson checks the formula and other special instructions for a particular job as operator Henry Bouvier carefully weighs out the correct amount of mix. That's the drying oven in the background and the press at right. This largely automated set-up is virtually unique in the industry."

"Petrographic Microscopy may be a jawbreaker but it's vital to effective grinding. Research Ceramist Irvin Havens here checks the relationship between abrasive grain and bond in a very hard wheel. Another project of his is to determine the importance of grain *shape*. If sufficiently improved performance can be gained by sorting abrasive grains for shape as well as size . . . Bay State wheels of the future will incorporate this additional refinement."

"What's a Sonic Grader? It's an electronic nightmare as far as I'm concerned. But to an expert like Bay State's Manager of Quality Assurance, Roy Leaman, it's an extremely advanced but very worthwhile device that helps give Bay State wheels an extra edge over competition. The wheel is excited by a gentle tap and the resultant tone, or frequency of vibration, is picked up by the microphone (lower right). The operator compares this frequency with a series of electronically generated notes until he has a perfect match. The result gives a more perfect matching of wheel formulations, when re-orders of particular wheels are required."

BAY STATE

BAY STATE
WHEELS of PROGRESS

"Better grinding at lower cost to you – that's our business . . . and that's what you see in the making here on these pages. We start with good ideas . . . but only the best ever pass our ruthless tests."

Elden L Anker

BAY STATE VICE PRESIDENT, MARKETING

"Sure, thermal tests are unspectacular but they're brutal just the same. Here a snagging wheel is placed in a heat chamber and peripheral surface is heated just as it would be in normal use . . . only more severely, by far. Thermocouples are imbedded into the side surface and here you see James McElroy checking the temperature gradient from periphery to center. Extreme differential between outer and inner temperatures eventually cracks wheels and only formulations with outstanding resistance to thermal cracking are ever put into production."

"Our vacuum mixing is a very critical process and Bay State leads in designing production machinery that ensures completely bubble-free material for honing stones. High vacuum in the mixing chamber forces even tiny bubbles out of the mix and rigid temperature control further guarantees uniformity of consistency. A technician is shown here pouring abrasive grain into the mixer preparatory to adding fluid bond material."

"Breaking the sound barrier? Well, you might think so when Bay State's new hot-pressed, high-speed snagging wheels are tested to destruction. Locked inside a huge steel drum, the big wheels are whirled at ever-increasing speed until they literally explode under the tremendous centrifugal stresses imposed. No wheel is put into production unless tests prove that it has at least a 4 to 1 safety factor. Bay State snagging wheels are now safety-rated at higher speeds than current grinders can produce. That's technician Clement Gareri removing shattered fragments of a wheel that burst into smithereens at one of the highest surface speeds ever recorded in the industry."

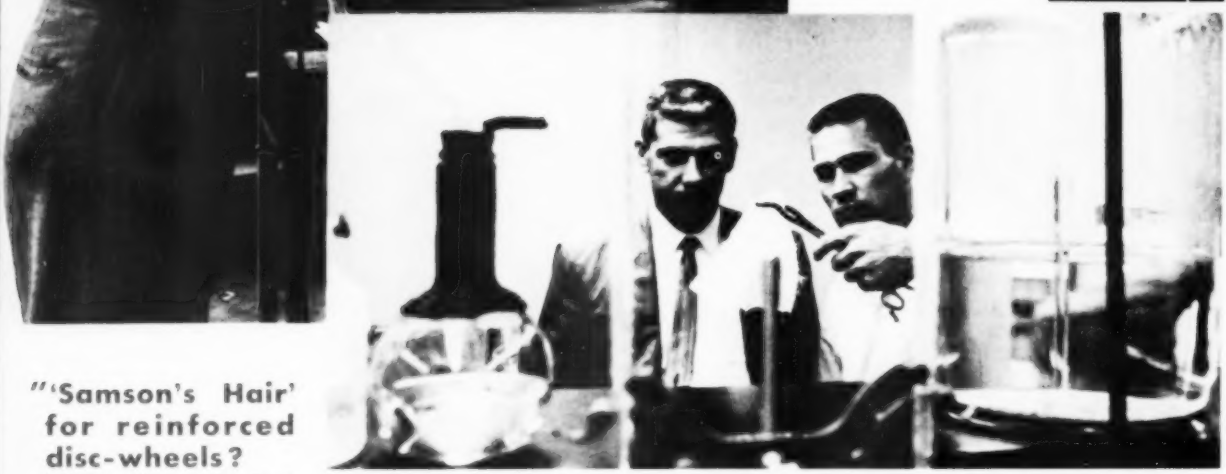
"Tensile strength, plus!

Figure-eight briquette samples of snagging wheel material are gripped in steel jaws and placed in a machine capable of exerting a direct pull of 50,000 lbs. Under the monstrous tensile loads imposed, even rock-hard snagging wheel material stretches before it breaks and the tests immediately show up formulations that resist tensile loads most effectively . . . and are therefore safest for use."

"Bay State's **QUALITY CONTROL** programs mean better grinding at low cost for you!"

"Measuring the air flow through the side of a cut-off wheel gives us an accurate check on wheel density. This test, being conducted here by Quality Control Manager James Gilman and Louis Silvestry, is made after pressing but before baking. Twenty four carefully distributed check points are tested so that the entire wheel is covered.

To the best of my knowledge, we're the only grinding wheel manufacturer to have developed such an accurate and comprehensive density-test for cut-off wheels."



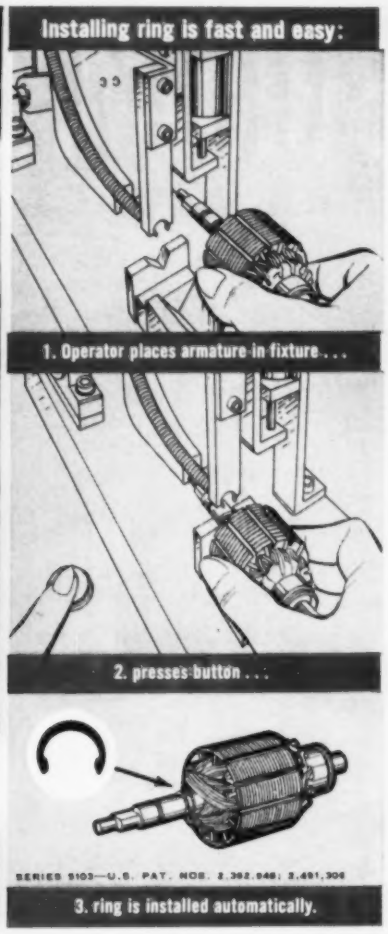
"'Samson's Hair' for reinforced disc-wheels?

What helps make Bay State disc-wheels so strong and so safe? It's the fiberglass reinforcement fabric, of course, but like Samson's hair, it has to be protected and one of Bay State's most jealously guarded secrets is the composition of the protective resin used for that purpose. This coating was the first and is still by far the best resin that successfully prevents crushing of the glass fibers during the manufacturing process. Here, Research Director Dr. H. Nathan Stone and Research Chemist Donald Grubba inspect a sample of fabric that has been removed from a *finished* wheel by burning away the bonding material in an electric furnace. The fibers are completely undamaged."

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.


Installing ring is fast and easy:
1. Operator places armature in fixture . . .
2. presses button . . .
SERIES 5103—U.S. PAT. NOS. 2,362,648; 2,491,304
3. ring is installed automatically.

Mechanized Truarc ring installation speeds assembly

eliminates costly shimming and gauging operations

Fast, semi-automatic assembly and the elimination of costly production operations are among the benefits Leece-Neville Co., Cleveland, Ohio, derives from the use of Truarc retaining rings in the manufacture of its fractional horsepower automotive motors.

Radially-assembled Truarc Series 5103 Crescent® rings—supplied pre-stacked—are used to position and lock the armature in the motor housing. Using the special Truarc pneumatic applicator-dispenser illustrated above, the operator merely inserts the rotor and presses a release button. The ring is installed automatically in a pre-cut groove on the rotor shaft!

The precision manufactured Truarc rings, seated in accurately located grooves, reduce accumulated tolerances from a possible maximum of .184" to .025". Costly, time-consuming shimming operations previously necessary to take up end play are eliminated, together with as many as four gauging operations required to select and place the shims.

The Leece-Neville story is just one example of the way Truarc retaining rings are stepping up production on today's fast-moving assembly lines. These versatile fastening devices simplify design, speed assembly and eliminate rejects. In replacing conventional fasteners, they often improve product performance and reliability. All of these advantages are in addition to substantial cost savings!

Truarc retaining rings come in 50 functionally different types . . . up to 97 different sizes within a type . . . 6 metal specifications and 13 finishes. Special Truarc hand, magazine and automatic applicators and grooving tools make production-line application easy on virtually every type of product. Make sure you have on file the new 16-page Truarc assembly-tool catalog No. AT 10-58. Write for your copy today. And remember Waldes Truarc engineers are always ready to assist you with your special production problems. Write: Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, New York. 9.13

WALDES
TRUARC®
RETAINING RINGS
Waldes Kohinoor, Inc., Long Island City 1, N. Y.

TRUARC RETAINING RINGS . . . THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS

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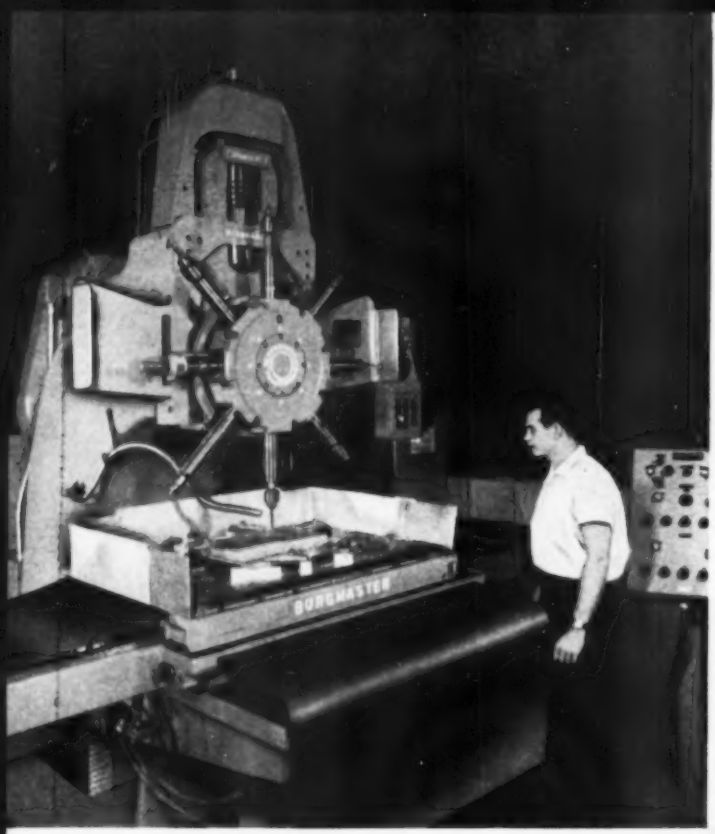
Tool Savings on Small Lots During

BURGMASTER *tape controlled*



Maximum Flexible Automation - - -

for Drilling, Boring and Tapping Lots of Any Size

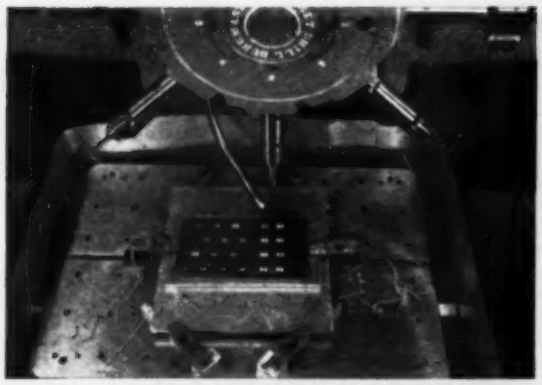
At Rocketdyne, small lots are no limitation in putting a part into automatic production on the tape controlled Burgmaster machine. The fact is, small lots bring into sharp focus the basic advantages of performing all close tolerance hole machining operations by this method.

- **jigs are eliminated and simple standard clamps may be employed to hold the work.**
- **costly tool room procedures for special tooling is greatly minimized.**
- **lead time is reduced since it requires much less time to program a part, prepare the tape, make the setup and get into production.**
- **surer faster production is assured because the Burgmaster follows the tape command signals exactly, and continues machining to close tolerances in the fastest possible manner.**
- **engineering changes are quickly put into production by the simple modification of a tape.**

Speed Production, Cut Costs of Experimental or R & D Parts.

Less time, from the drawing board to the finished part—this is the simple formula that works to your advantage when producing lots of any size with the tape controlled Burgmaster Turret Drilling Machine.

268 operations on 100 holes are produced 8 times faster on this Rocket Instrumentation Panel. During machining, one tool change is made on two spindles. Note the simple holding clamps.



World's Largest Builder of Turret Drilling Machines

"O" Manual Power Index ½" Capacity

1C Manual Power Index ⅝" Capacity

2B Manual Power Index ⅝" Capacity

2BF Flange Mounted Power Index ⅝" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity

2BR Ram Type Radial Drill ¾" Capacity

2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

1 Year Will Pay for $68,000.00

8 SPINDLE TURRET DRILL

Tool savings alone will pay for a $68,000 Tape Controlled Burgmaster Turret Drilling, Tapping and Boring Machine within a year, while producing small lots from 3 to 5 parts. In addition, the machine is producing up to 8 times more parts compared to conventional machining methods.

Time is the vital element in producing Research and Development hardware and production at Rocketdyne moves fast in order that parts in process will reflect improvements determined by latest tests. The tape controlled Burgmaster is an answer to getting into production fast and making engineering changes rapidly and inexpensively.

Parts are clamped on the 30" x 45" positioning table using an aluminum sub-base and simple clamps instead of expensive tooling with drill bushings. Table positioning is rapid and accurate, being automatically controlled by tape to accurately locate the work on two axis for each setting. The tape also controls the selection of proper spindle sequence and all machine functions. In addition, all standard adjustable Burgmaster controls are maintained including pre-selective spindle speeds, infinitely variable pre-selective feeds, selective rapid approach and return, skip indexing, precision depth control and simple manual controls for making fast set-ups. As a result, all operations are carried out at their most efficient rate for high finish, precision, speed and longest tool life.

INQUIRE TODAY at no obligation how you can save time with Automatic Tape Controlled Production. There is a Burg representative or dealer near you that will supply all the facts.

SEQUENCE OF 268 MACHINING OPERATIONS

Spindle No.	Tool	No. of Holes	Speed	Feed
1	No. 1 Centerdrill	72	2400	.003
4	No. 4 Centerdrill	28	2400	.003
2	.159 Drill	52	1540	.005
6	Tap 10-32NF-3B Tapmatic Head	52	330	.031
7	.136 Drill	16	2400	.003
3	Tap 8-32NC-3B Tapmatic Head	16	330	.031
5	1.06 Drill	10	490	.003
8	.75 Drill	11	770	.003
1*	.406 Drill	7	1200	.004
4	.218 Drill	4	2400	.004

* NOTE: Tape is programmed to stop machine after drilling eleven .75 Holes with Spindle No. 8. Tools are changed on Spindles No. 1 and No. 4 per above chart, then automatic tape controlled operation is resumed by depressing the start button on the master panel to complete the last 11 holes.

Job Facts

Machine:	Burgmaster 3BHT 8-Spindle Turret Drilling, Tapping and Boring Machine with 30" x 45" Positioning Table and GE Tape Controls.
Company:	Rocketdyne, a Division of North American Aviation, Inc., Canoga Park, California.
Part:	Rocket Instrumentation Panel.
Material:	1020 steel plate, ¼" x 9" x 18".
Operations:	Centerdrill and drill 100 holes, tap 68 holes: a total of 268 operations.
Holding:	Standard clamps.
Quantity:	Five parts.
Accuracy:	Table positioning to ±.001".
Former Method:	Line of single spindle drills using drill jig.
Former Time:	One part per day.
Present Time:	Eight parts per day.
Advantages:	Increased production 8 to 1, lead time drastically reduced, tool saving alone will approximately pay for $68,000.00 Burgmaster Machine within a year.

Write for Bulletin describing Burgmaster 6 and 8 spindle Tape Controlled Turret Drilling, Tapping and Boring Machines. See Burgmaster Machines in action: Thirty-minute 16mm sound film showing all Burgmaster Turret Drills in operation is available from any Burg office without charge.

BURG TOOL
MANUFACTURING COMPANY, INC.
15001 South Figueroa Street, Gardena, California
FAculty 1-3510 DAvis 9-4158

BURGMASTER

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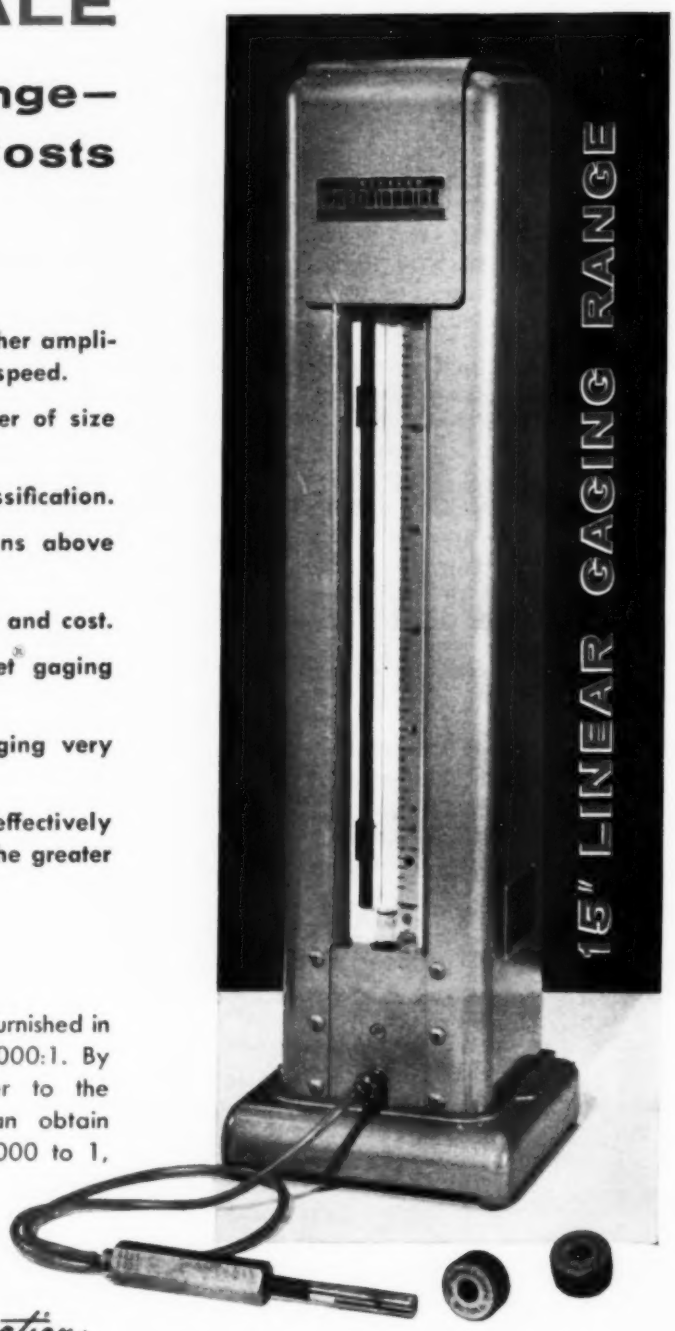
Plus dealer representatives in other industrial centers.

New LONG-RANGE PRECISIONAIRE®

with 15" LINEAR SCALE

Triples Gaging Range— Cuts Inspection Costs



Cost Saving Benefits

This new idea enables you to:

- Inspect wider part tolerances at higher amplifications with greater accuracy and speed.
- Classify parts into a greater number of size increments.
- Widen the scale spread for each classification.
- Accurately measure those deviations above and below tolerance limits.
- Reduce gaging equipment inventory and cost.
- Double the amplification of Plunjet® gaging cartridges.
- Obtain full amplification when gaging very small diameters.
- Watch machining operations more effectively with in-process gaging because of the greater come-up or approach interval.

Broad Amplification Range

The new Long-Range Precisionaire Gage is furnished in standard amplifications of 5,000:1 or 10,000:1. By adding the Sheffield Pneumatic Amplifier to the 10,000:1 Long-Range instrument, you can obtain 20,000, 40,000, 50,000, 80,000 or 100,000 to 1, amplification.

8362

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of Bendix Aviation

manufacture and measurement for mankind

Call your local Sheffield representative for a demonstration or write to the Sheffield Corporation, Dayton 1, Ohio, U. S. A., Dept. 1.

You name it . . .

ROLL or CYLINDRICAL GRINDING

with Coated Abrasive belts reduces "set-up" time

The use of coated abrasive belts for roll or cylindrical grinding is spreading rapidly. New machines are being introduced and many conversions are being installed.

The reason for the popularity of this easy-to-work system is that it gives better finishes and requires less set-up and adjusting time.

Ask your BEHR-MANNING representative how coated abrasive roll or cylindrical grinding can save you time and money — or write direct to Dept. AM-10.

BEHR-MANNING CO.
TROY, NEW YORK
A DIVISION OF NORTON COMPANY

NORTON ABRASIVES®

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
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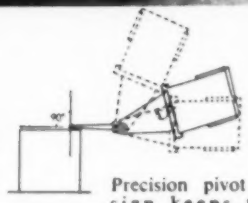
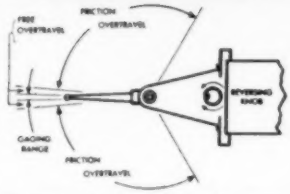
electro-probe.

Yes, the Electro-Probe does measure to high accuracies, even with a set-up as limber as this. It's the *only* gage that can!

1 By far the lowest contact pressure of any electronic gage . . . only 2.5 grams . . . a precision touch so light that you can gage *dependably, in the shop* without the need for highly rigid, heavy-weight stands. Only with the Electro-Probe do you get high accuracy gaging using an ordinary test set or other *easily* available fixture.

2 

Precision pivot design keeps this feather-light pressure virtually constant throughout range to maintain necessary gaging accuracy (change is less than 0.1 gram per .001" of contact travel). This pressure uniformity is found only in the Electro-Probe. AND only in the Electro-Probe is this pivot point properly located so that magnification *remains constant* with changes in gage head position.

3 

You can use the Electro-Probe anywhere safely and conveniently. Gage head and cord are impervious to oil and water. Contact can be positioned anywhere within arc of over 200° and is clutch-mounted for complete overtravel protection. Small ball tip on contact lets you check where other electronic gages cannot. Other size tips available.

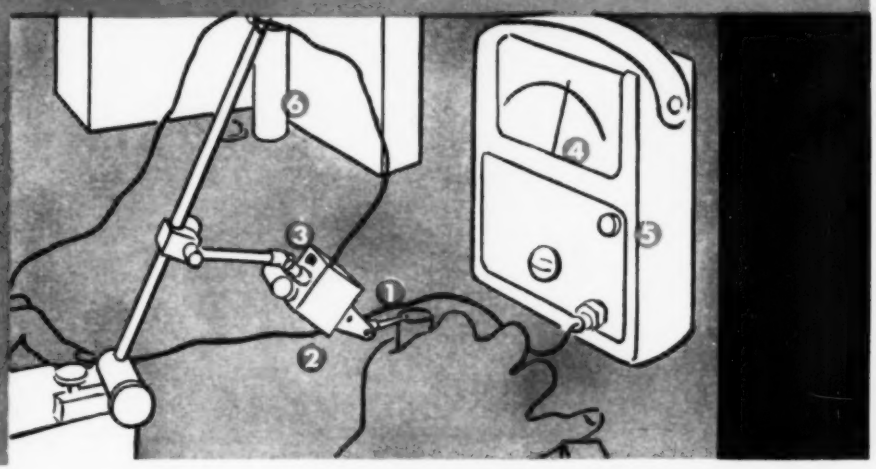
Ask FEDERAL *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

the original and still by far the best low cost, portable, electronic gaging unit

ITS *feather light* TOUCH MAKES THE BIG DIFFERENCE



4 Wide view dial has accurately calibrated, clearly marked scales. Pointer is needle thin for precise, unconfused readings. You choose any two magnifications you want from 100 X to 10,000 X. Lowest magnification gives you ± .020" range and .001" min. grad.: highest gives ± .0002" range, .000010" min. grad. Lightweight amplifier uses high-reliability transistors that outlive vacuum tubes 20 or 30 to 1. Mercury cell batteries provide long life, constant voltage, drift-free operation; give you an *electronic* gage which has *instant* start up. No slow-charge batteries and dangling AC cords to impair its use and portability.

5

Wide range electrical zero adjustment lets you set-up quickly, without the need for close, time-consuming mechanical adjustment of the gage head. For convenience, zero settings and readings coincide on both scales. Printed wiring is rugged and mounted on extra-thick, heavy duty card to give you lifetime dependability.

6

The Electro-Probe is truly a gaging UNIT — comes equipped with holding bars and rods, plus swivel clamp and variety of backs — all you need for mounting the head on available test-set stands and similar fixtures. The gage head, self-powered amplifier and accessories are packaged for portability in one lightweight metal carrying case . . . and the Electro-Probe has the lowest price tag of any comparable instrument, even those that provide only a gage head and amplifier!

Want a demonstration? . . . gladly, at your convenience.

Brochure available, write . . . **FEDERAL PRODUCTS CORP.**

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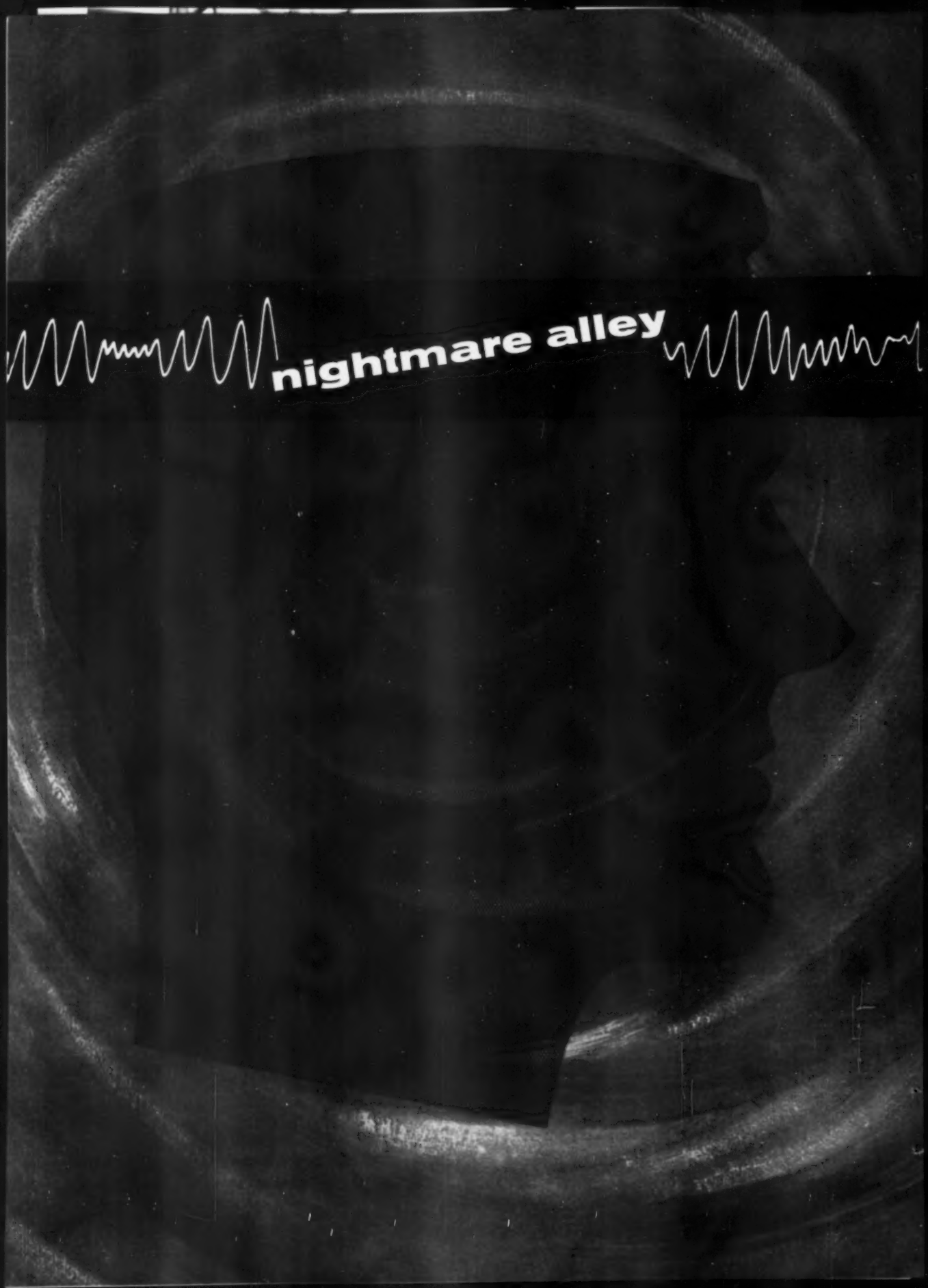
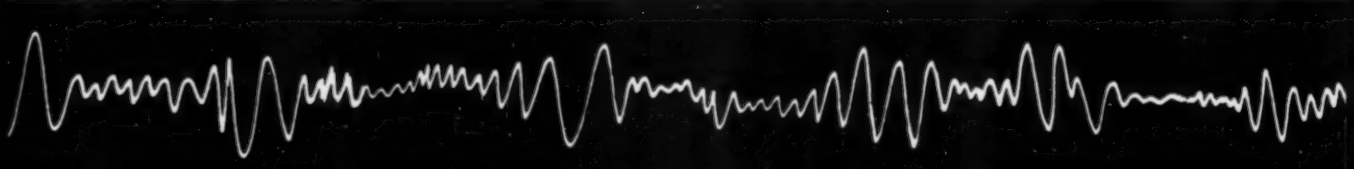

nightmare alley



Not knowing what's going to happen next—this is the most upsetting aspect of nightmares . . . and buying and using many stainless steels.

When you order stainless steel from your nearby *Carpenter* SERVICE-CENTER, you know *in advance* what you're getting:

Predictable performance! Every bar, every order, assures you the advantages inherent in maximum uniformity. You hold production and service problems to a minimum. *Carpenter* has taken the guesswork out of stainless.

Large local stocks! Billet, bar or wire . . . your *Carpenter* SERVICE-CENTER has it. We stock an unusually wide range of grades and sizes to accommodate your most diversified needs.

Technical help extraordinary! No matter how difficult your problem, there's an excellent chance that *Carpenter's* continuing Research and Development Program has already produced information to save you time and money. Other progressive companies take advantage of our metallurgical services. Why don't you?

tool and die steels
stainless steels
electronic, magnetic and electrical alloys
high temperature alloys
special-purpose steels
tubing and pipe
fine wire specialties

***Carpenter* steel**

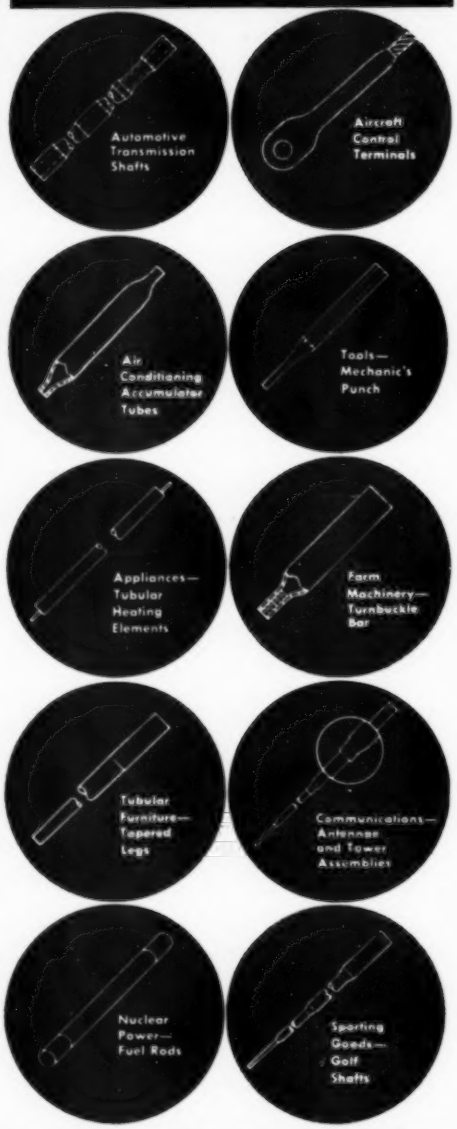
a new company 70 years old

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

◄ CIRCLE 217 READER SERVICE CARD

CIRCLE 218 READER SERVICE CARD

WHAT TORRINGTON ROTARY SWAGING MACHINES CAN DO FOR YOU

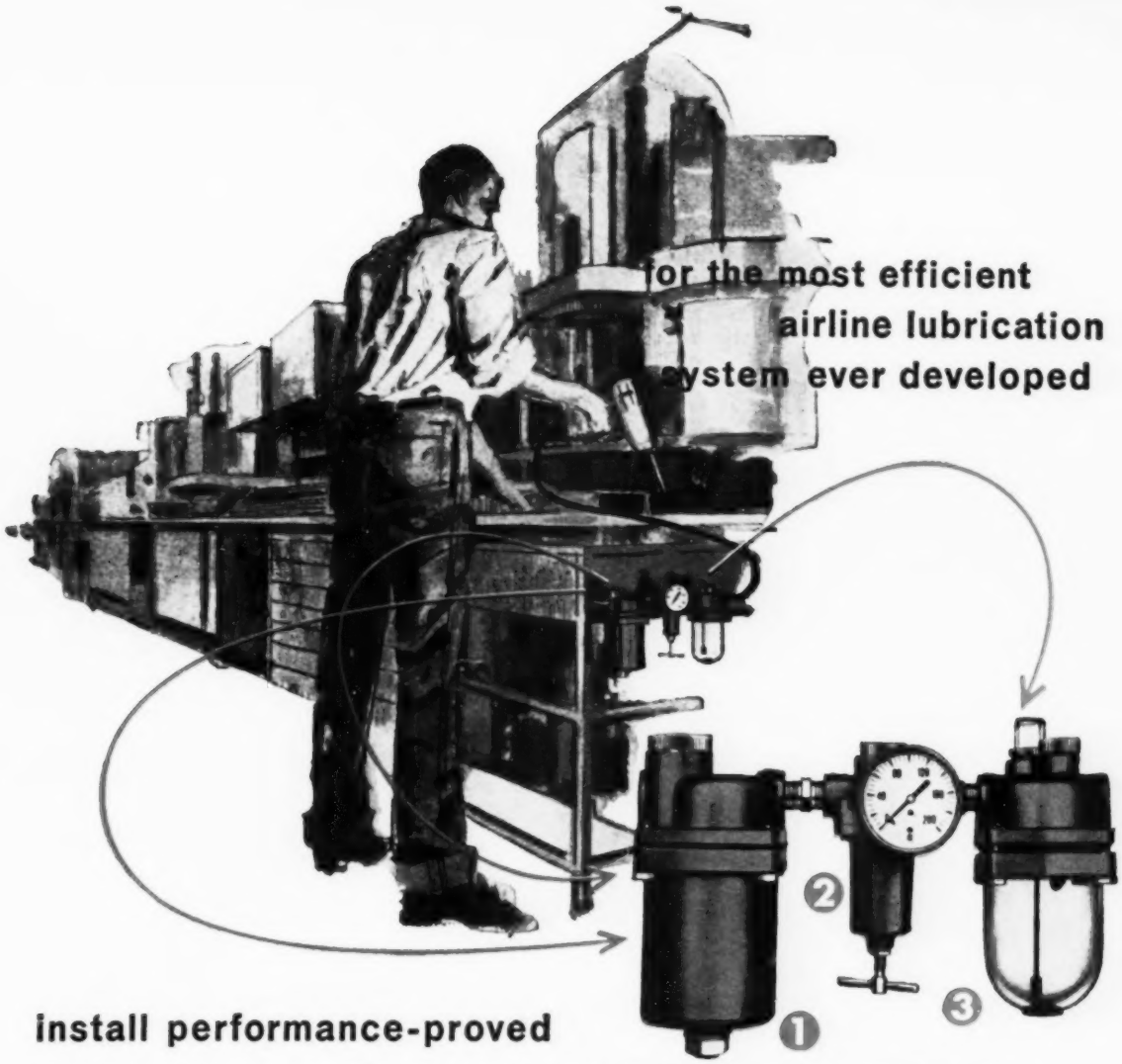


These versatile, efficient machines shape metal parts by hammering between dies instead of cutting stock away. They give you a full pound of parts from every pound of metal. They also save you time and labor. Swaging is usually the fastest way to point, taper, reduce or bond metal parts. Tooling is simple and surprisingly inexpensive.

There is no greater authority on swaging than Torrington. Torrington pioneered the swaging process, designed the original equipment and has constantly improved it through innovations in methods and engineering. Today, Torrington operates more swaging machines than any other company in the world. The experience of our engineers is unparalleled. We maintain experimental shops to help you solve your special swaging problems. If you have a part that can be swaged we can design and produce "Job-Tested" dies to your specifications. Come to Torrington with your swaging problems—we have the answers. The Torrington Company, Swaging Machine Division, 200 North St., Torrington, Conn.

TORRINGTON ROTARY SWAGING

SWAGING HEADQUARTERS, U.S.A.



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Complete Alemite package assures cleanest, driest, best-regulated lubrication of air tools, air cylinders, air motors, and many other types of air-operated equipment. Specifically designed for extensive service life and peak efficiency under adverse operating conditions!

1 Automatic Water Separator. Removes all of condensate, all the time. Traps dirt particles to prevent damage to sensitive airline devices. Handles all airline pressure up to 200 PSI and flow volume from 5 to 50 CFM.

2 New Air Regulator with Gauge. Assures accurately controlled air—prevents erratic operation and damage to equipment. Design permits inlet pressures of 250 PSI—adjustments up to 125 PSI. Excess air pressure "bleeds off," within regulator, instantly.

3 Automatic Airline Lubricator. Compensating ball valve design controls air flow. Oil particles are atomized for most efficient transmission through supply lines. Result—uniform mixture regardless of air pressure and volume. Oil and air mixture proportionately constant. Reservoir may be filled at any time, assuring continuous operation. Nine-ounce capacity.

Symbol of SW Excellence

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Mail coupon for full details!

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Please send me all the facts about Alemite's new "Tri-Duty" Airline Controls.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

CIRCLE 220 READER SERVICE CARD

Columbium

makes possible

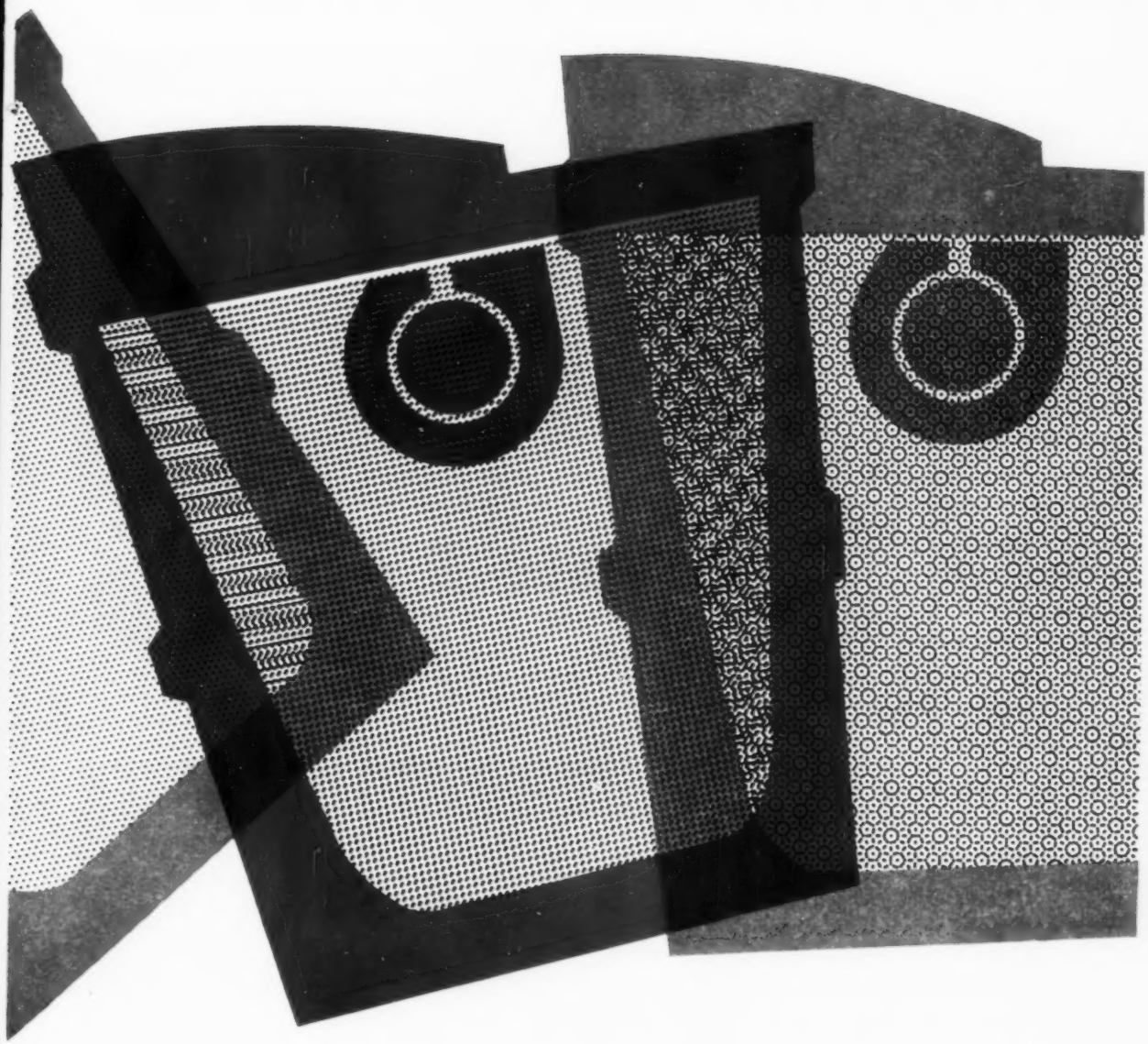
this unique

new

fine-grained

carbon steel

GLX-W



Compare fine-grained GLX-W with the steel you use

Great Lakes adds a precise amount of columbium to good-quality carbon steel. The result is fine-grained GLX-W steel. Here's how GLX-W compares with mild carbon steels . . .

- GLX-W is 50-100% stronger
- Has greater notch toughness
- Has excellent weldability
- Is as ductile as other carbon steels
- Permits designers to reduce weight up to 35%.

For proof on how GLX-W can cut your production costs, write, wire or phone Great Lakes Steel Corporation, Product Development Division, Department X.

GLX W

GREAT LAKES STEEL

Detroit 29, Michigan

A DIVISION OF NATIONAL STEEL CORPORATION

CIRCLE 222 READER SERVICE CARD

SUNDSTRAND *"Engineered Production"* NEWS

Cut milling costs with standard Rigidmils* and Sundstrand "Engineered Production"

Determining the most profitable processing method, then selecting the machine to suit this method — that's Sundstrand "Engineered Production" at work.

To offer full benefit of the most profitable method, Sundstrand builds a wide range of standard machines as well as semi-standard and special machinery. From Sundstrand's extremely wide choice in table sizes, strokes, spindle speeds, horsepowers, controls and basic elements, you can get a standard machine with customized features for your particular job — yet one that can be readily converted to other jobs.

Sundstrand Rigidmils have been tooled in many ways to lower production milling costs. A few typical examples are shown. Countless plants using Sundstrand machines with "Engineered Production" methods and accessories have found them productive and economical. Call in a Sundstrand engineer to assist you with your milling problems. There is no obligation for this service.

Triplex Rigidmil

Two opposed side pads and one top pad are milled simultaneously on differential carrier parts with this triplex type Rigidmil. Vertical adjustment of side heads, endwise adjustment of spindles, and easily adjusted table feed stroke provide machine flexibility for future change in part sizes.

Duplex Rigidmil

Ten locating and transfer pads on opposite sides of cast iron cylinder heads are milled simultaneously, using carbide cutters. Output is approximately 28 parts per hour.

***Milling Machines**

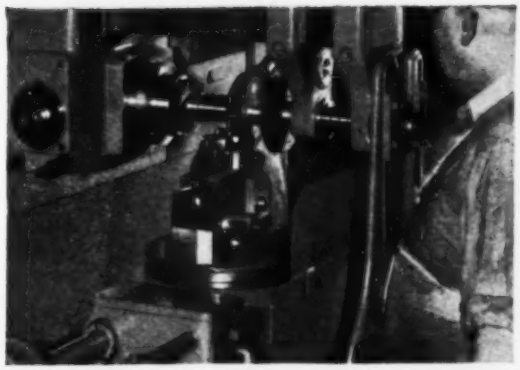
Learn more about the application of Sundstrand "Engineered Production" to the solution of your milling problems by writing today for Bulletin 108.

"Engineered Production" Service

SUNDSTRAND

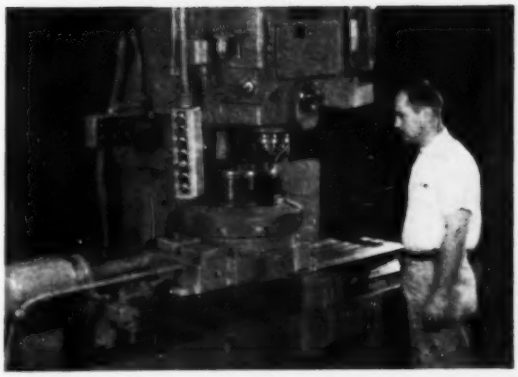
Simplex Rigidmil

Straddle milling both sides of stainless steel fuel nozzle, one at 140° and the other at 166°, and mounting work in dual fixture on an automatic index base boosted production materially. One side of the fixture is unloaded and reloaded while cuts are taken at the other side to make loading time free.



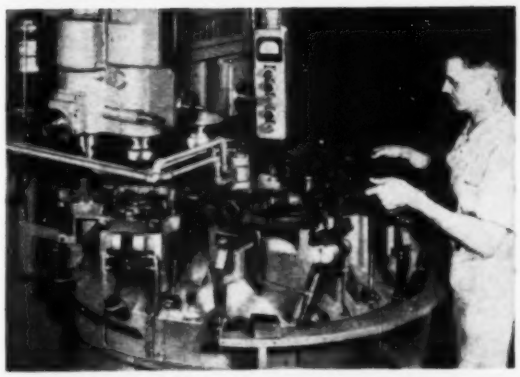
Vertical Rigidmil

Machining time was reduced 82% in milling 28 scallops on the periphery of a steel housing, when put on this standard vertical Rigidmil with a standard automatic index base attachment. Cycle is completely automatic including indexing. Operator only loads and unloads fixture.



Rotary Milling

This Rigidmil with rotary table makes possible a continuous milling cycle. Loading and unloading time is eliminated—operator loads and unloads while cuts are in progress. Machine shown has multiple spindle head so that ruff and finish cuts can be made with one locating and clamping of the workpiece.



Tracer Equipped Rigidmil

This Sundstrand C-5 Rigidmil equipped for tracer milling lost no time in effecting major savings when put on the job machining tool steel. Savings up to 75% over previous methods were made on the many different parts now run over this machine. Easy setup for various parts changes provided additional benefits.

SUNDSTRAND MACHINE TOOL

DIVISION OF SUNDSTRAND CORPORATION

BELVIDERE, ILLINOIS

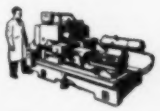
SUNDSTRAND

More facts about

SUNDSTRAND

"Engineered Production"

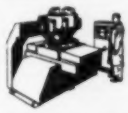
Literature listed under various machine types has more details. Write Sundstrand for your copy today.



Automatic and Tracer Lathes
Bulletin A-108

Engineered Milling Production
Bulletin B-108

Examples of Transfer Machines—Bulletin C-108

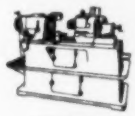


Multiple-spindle Drilling Machines—Bulletin D-108

Internal and Rotary Surface Grinders—Bulletin E-108

Broaching Tools
Bulletin F-108

Practical Broaching Methods
Bulletin F-108

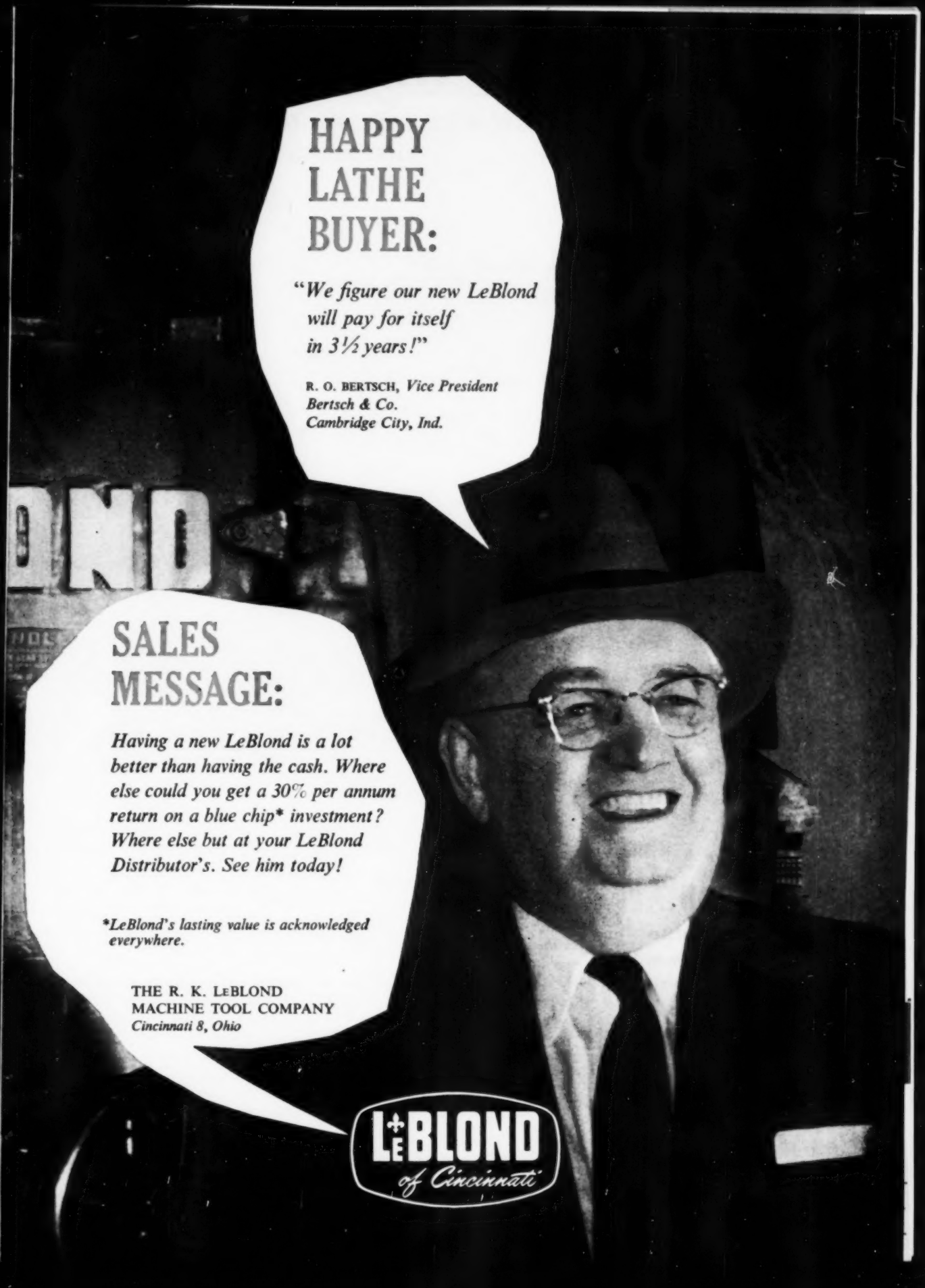


Thread Milling
Bulletin G-108

CIRCLE 224 READER SERVICE CARD

CIRCLE 225 READER SERVICE CARD ▶

HAPPY
LATHE
SALESMAN:
"This new 50" LeBlond
sold for more
than $100,000!"
O. W. "DOC" SHULL, Sales Engineer
Technical Equipment Sales Co.
LeBlond Indianapolis Distributors


HAPPY LATHE BUYER:
"We figure our new LeBlond will pay for itself in 3½ years!"
R. O. BERTSCH, Vice President
Bertsch & Co.
Cambridge City, Ind.
SALES MESSAGE:
Having a new LeBlond is a lot better than having the cash. Where else could you get a 30% per annum return on a blue chip* investment? Where else but at your LeBlond Distributor's. See him today!
*LeBlond's lasting value is acknowledged everywhere.
THE R. K. LeBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio
LeBLOND of Cincinnati

the NEW *Roto-Finish* VIBRATRON . . .

THE COMPLEX FINISHING JOBS IT DOES . . .
THE *REAL* MONEY IT SAVES!

VIBRATRON...
the profitable way to precision, mass production finishing

ROTO FINISH

In the Vibratron, complex parts with shielded and hard-to-reach internal surfaces can be precision finished *mechanically* ending costly hand operations. *All* surfaces of the part are exposed to abrasive action *all* of the time. Time cycles are cut 300%, 500%, even more; so media and compound costs go down too!

Equally important, the Vibratron puts an end to manual handling of parts and media. A built-in, removable, double-decked vibrating separator separates parts and media, as well as fragments from the media in one simple operation. There's no need for an extra separator.

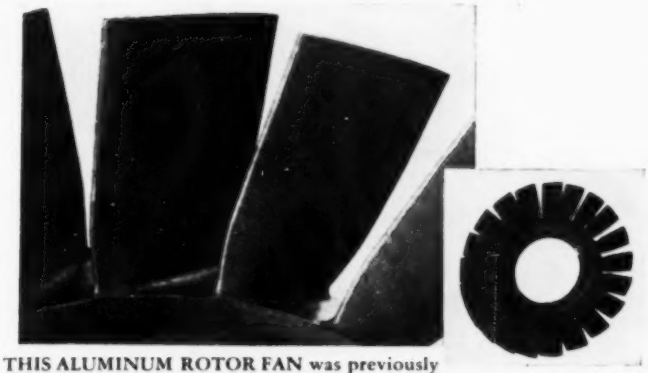
The Vibratron is simple in design. Uses standard, *tested* components which require minimum maintenance. Power requirements are low. Fixturing is easy because of the open tank design. Another advantage . . . noise level is at a low hum. The machine need not be bolted down.

Roto-Finish / RANSOHOFF

FOREIGN REPRESENTATIVES: ARGENTINA—Taller—Buenos Aires ● AUSTRALIA—A. Flavell Ltd. Cheltenham ● BRAZIL—Commercial E. Industrial de Fornos Werco, Ltd.—Rio de Janeiro ● CANADA—Canadian Hanson & Van Winkle Co., Ltd.—Toronto ● ENGLAND—Roto-Finish Ltd.—Hemel Hempstead ● FRANCE—Societe Roto-Finish—Paris ● GERMANY, AUSTRIA, NORWAY, SWEDEN, SWITZERLAND—Metallgesellschaft A. G.—Frankfurt, a. M.—Germany ● HOLLAND, BELGIUM, LUXEMBURG—N. V. Roto Finish Maatschappij—Delft, Holland ● ITALY—Societa Roto-Finish a R. L.—Milan ● MEXICO—Enthone de Mexico, S. A. Prol Pino 889, Mexico 18, D. F. ● SPAIN—Instituto Electroquimico, S. A.—Barcelona

NOW THERE'S NO NEED FOR HAND FINISHING OPERATIONS ON PARTS LIKE THESE . . .

The above diagram shows how the Vibratron work zone extends throughout the abrasive mass. Every part is subject to a constant abrasive action.



THIS ALUMINUM ROTOR FAN was previously deburred, and *still* surface irregularities were not removed. IN THE VIBRATRON they are fixtured 10 parts per machine. Time cycle: one hour. No hand work required. Surface greatly improved.

Before Vibratron processing this aluminum sand casting (shown above) was hand deburred, then tumbled into a multiple compartment machine for 30 minutes. IN THE VIBRATRON it is processed 4 parts to a machine. Time cycle: 15 minutes. No hand operations required. Finish is far more uniform.

It took two belting operations *and* 20 hours of tumbling to blend in grinding lines on these forged shears, still parts were sometimes distorted during processing. THE VIBRATRON time cycle is 6 hours. No hand work required. No part distortion.

This complex business machine part previously required hand deburring because barrel finishing bent the parts. IN THE VIBRATRON 100 parts are completely deburred in a 30 minute cycle.

With the Vibratron . . . you can clean, descale, deburr, form radii, fine-finish and color stamped, cast, forged and machine parts, finish them faster . . . better . . . and more economically.

LET US PROVE IT TO YOU

Send a few unfinished parts to us . . . and a finished part to use as a guide. *We will process them for you and guarantee the same results in your plant as we get in our finishing laboratory.*

Roto-Finish COMPANY
3723 Milham Road, Kalamazoo, Michigan

☐ My parts are on the way to you.

☐ Please have Roto-Finish factory representative call for an analysis of my finishing problem.

Name _____ *Title* _____

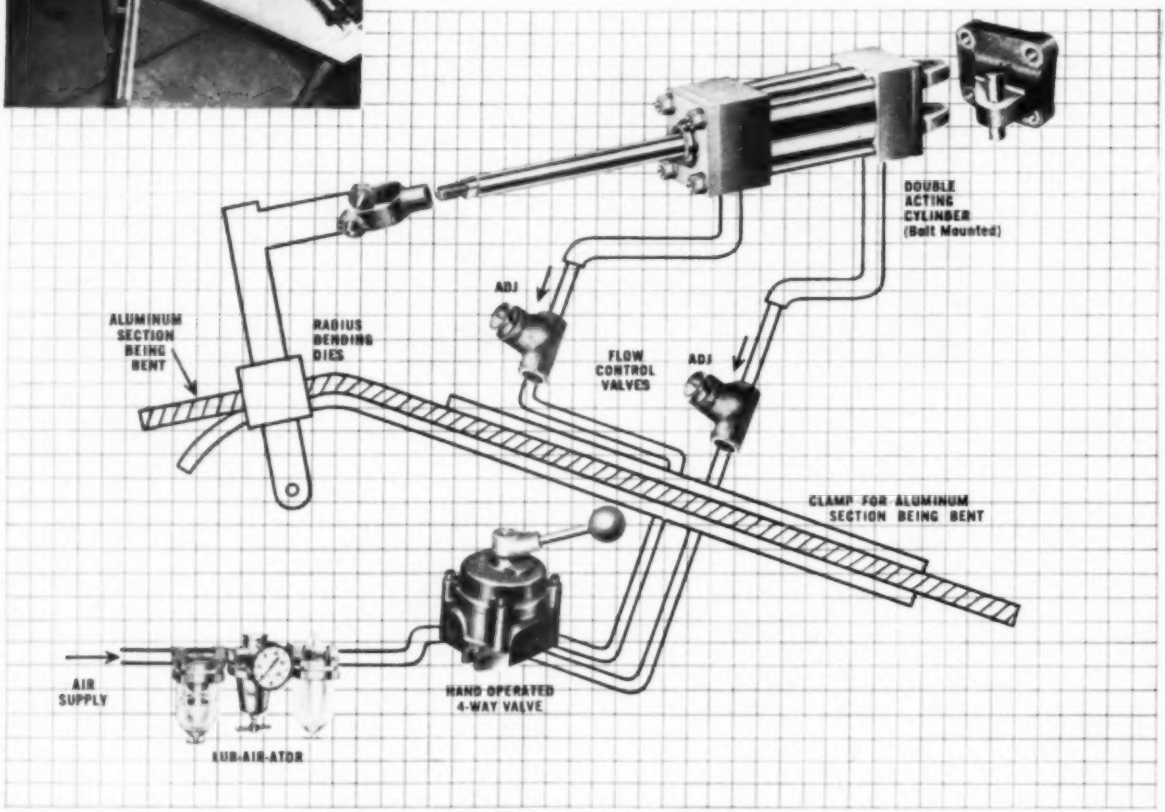
Company _____

City _____ *Zone* _____ *State* _____

Call on Roto-Finish / **RANSOHOFF for complete "finishing-engineering" service**

CIRCLE 228 READER SERVICE CARD

A typical example of how fabricators use Schrader. Schrader Air Products in the schematic perform a metal-forming operation at Lance Awning Corporation, Lake Worth, Florida. Power is supplied by a Schrader double-acting bolt-mounted air cylinder. By pressing the Schrader 4-way valve, the cylinder piston advances at proper speed, checked by Schrader flow control valves, bending an aluminum section to the desired angle. Reversal of the 4-way valve returns the cylinder and bending dies to rest, permitting removal of the bend section. "Air control provides a straightforward one-man job," says the Plant Manager. "Two men worked hard to form this radius bend on 25 parts per hour before a Schrader Air Cylinder was installed. Now one man forms 35."



FABRICATOR JUMPS PRODUCTION 40%... CUTS COSTS IN HALF WITH STANDARD SCHRADER AIR PRODUCTS

Get higher production at lower cost, just like this company . . . with the *air* you already have! You can't beat Schrader Air Products for accuracy, economy, speed —and lasting quality.

Air can save manhours . . . slash operating costs . . . upgrade practically any operation such as inspecting, assembling, testing and packaging. It can push, pull, hold, position and move work repetitively . . . make light of weight-lifting . . . accelerate production . . . unplug bottlenecks . . . all at unmatched low cost and drop-in-the-bucket maintenance.

You get the finest line of Air Cylinders, Valves and Accessories from Schrader. Plan hookups yourself. You get expert help and ideas for cutting your operating costs from experienced Schrader Air Specialists.

Select your automating equipment from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data write:

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QUALITY AIR CONTROL PRODUCTS

NEW HAMPSHIRE BALL BEARINGS, INC.
PETERBOROUGH - NEW HAMPSHIRE

ARTHUR N. DANIELS
PRESIDENT

July 13, 1959

Mr. N. A. Leyds, General Manager
Bryant Chucking Grinder Company
Springfield, Vermont

Dear Mr. Leyds:

It is a pleasure to congratulate you for your Company's development of the new miniature Centalign internal grinders, from our point of view the outstanding machine tool design of the past ten years.

I feel that your engineers, designers, production people and those who made this decision are to be highly commended for this achievement.

Sincerely,

A. N. Daniels
President

AND/im

BRYANT CENTALIGN

SWITCHING TO ADAMAS CARBIDE GRADE 548 GIVES OLIVER 170 MORE PIECES PER INSERT

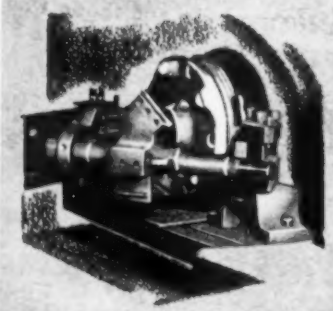
-cuts downtime by 75%

Oliver Corporation—never satisfied until they are sure they have the best—wanted greater production, per carbide cutting edge, in machining front tractor wheels. Shown discussing the problem are Lyle Bushbaum, Divisional Foreman; A. G. Obermeier, Shop Supt.; of Oliver's Charles City, Iowa plant; and Adamas Service Engr., Walter Sukiennik.

The machines in use are P & J automatic turret lathes. Using brazed tools on the hard cast iron parts, production never exceeded 50 pcs. per sharpening. Mr. Bushbaum, examining the operation, considered using throwaway inserts but questioned their ability to stand up under the heavy shock conditions.

OLIVER CORPORATION
"NEVER SATISFIED UNTIL
IT HAS THE BEST"
BUYS TUNGSTEN CARBIDE
ON PERFORMANCE...
NOT HABIT!

If you are interested in improved efficiency, economy, quality — let's hear from you . . . the coupon is for your convenience.



It was finally decided to set up the lathes with Adamas' Dex-A-Tools and Grade 548 throwaway inserts. This combination proved to be very rugged, and efficiently handled the operations involving a series of interrupted cuts of 3/16" in depth, with a .017 feed at 340 sfpm.

The change to Adamas' Dex-A-Tools and Grade 548 enables Oliver to step up production to 480 pieces per carbide insert and drastically reduce downtime. This is in sharp contrast to the previous output of 50 pcs. per sharpening with a well known competitive grade. Production per corner now averages 80-100 pcs.

Producers of
Tungsten Carbide Tools,
Tool Tips,
Dies, Wear Parts
Dex-A-Tool

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

☐ Please send new Adamas Catalog No. 359 ☐ Please have an Adamas representative call ☐ Please send new Adamas Carb-A-Guide Selector

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Feature for feature.
Price for price...

this
CINCINNATI 16" ROYAL DRILL
is your BEST DRILLING BUY!

CHECK LIST FOR DRILLING AT A PROFIT

SPINDLE ACCURACY
6-spline spindle mounted in 4 precision bearings—one at TOP and bottom of spindle pulley.

BUILT-IN ELECTRICS
Complete controls with overload protection built into the head.

POSITIVE DEPTH GAGE
Easy-to-read gage is graduated in 1/16". Quickly set for positive stop at desired position.

RAPID SPEED CHANGE
Tilting motor bracket provides easy belt shifting for five spindle speeds.

SPACIOUS TABLES
Large working surface of tables and bases, with massive 3" column design provide unusually wide work range.

APPEARANCE
Streamlined functionally for maximum safety and operating ease.

ACCESSORIES
Profit-boosting attachments and accessories include automatic air feeds, electrical tapping units, motor driven coolant pump, and others.

The CINCINNATI 16" ROYAL Drill is a real metal-working drill, built to machine tool quality standards by a machine tool builder. This is a multi-purpose machine—it handles light drilling on a production basis, as well as being ideal for utility operations. With CINCINNATI quality built-in, a ROYAL holds its accuracy longer—stays on the job longer.

*Only $128 for the Cincinnati 16" Royal bench type drill shown. Complete with 0"—½" chuck or #2 M.T. spindle, built-in single phase manual control with overload protection—less motor. Floor model, as above, only $143.

ROYALS are built in bench and floor types, single and multiple spindle 16" models with ⅝" drilling capacity in cast iron. Also 18" models with 1" capacity in cast iron.

Talk it over with your CL&T Dealer, or write us direct.

Improved Machining Through Research

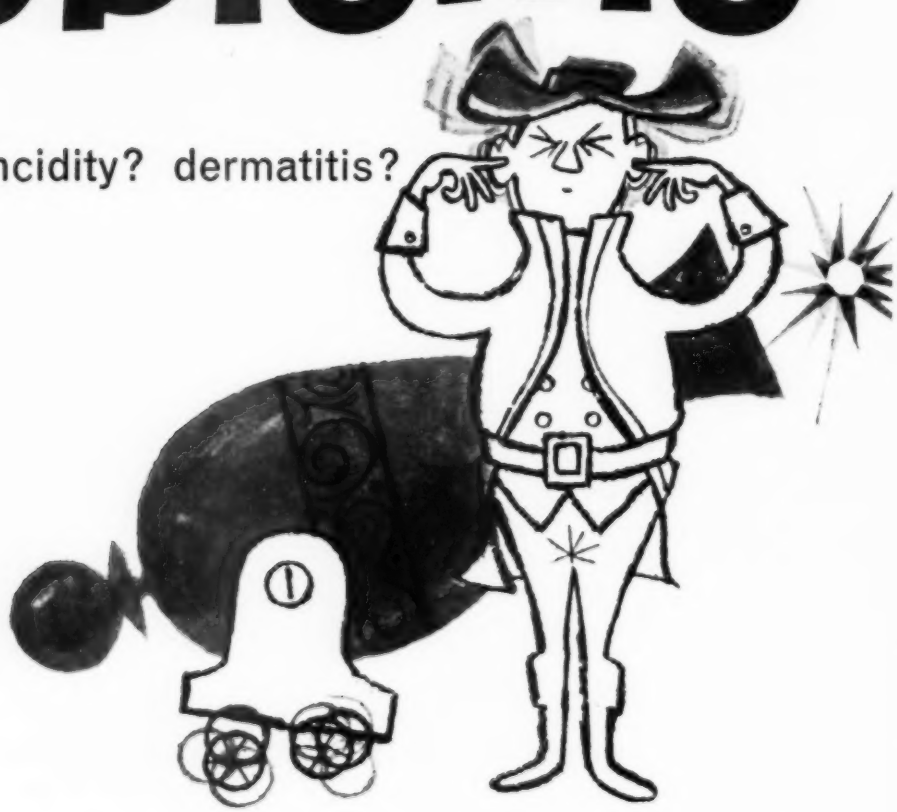
CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

coolant problems

rust? rancidity? dermatitis?



Cold Stream stops rust resists rancidity reduces causes of dermatitis These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you everything you ever expected in a coolant!

JOHNSON'S

cold stream

Stays clean week after week and gives you all the performance you pay for.

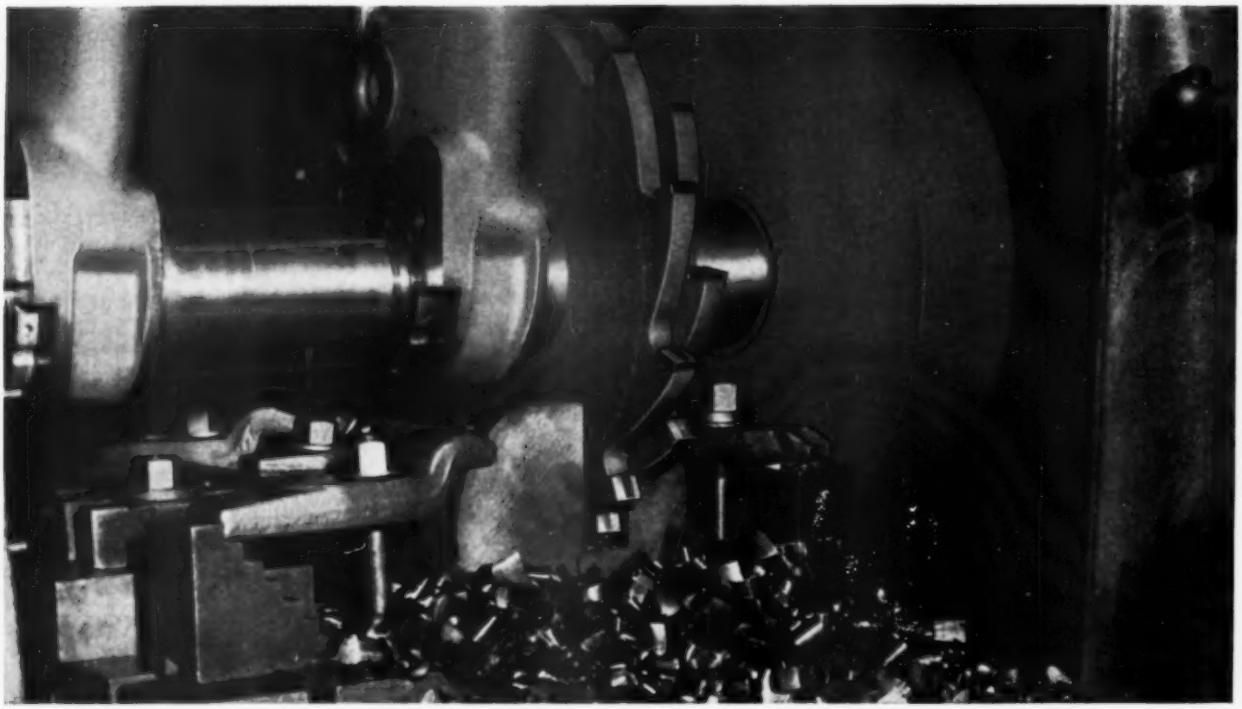
JOHNSON'S WAX

For information, see your local Johnson industrial distributor.

"Cold Stream" and "Johnson's" are trademarks of S. C. Johnson & Son, Inc., Racine, Wisconsin

ACCURACY

. . . STOCK REMOVED 92% TO 400% FASTER, CUTTER LIFE INCREASED PROPORTIONATELY, HIGH-STRENGTH ALLOYS MACHINED AT CONVENTIONAL SPEEDS AND FEEDS!



A SIGNIFICANT FORWARD STEP IN CUTTING TOOL DESIGN . . .
these new Splined Cutters and Arbors are ideal for all types of heavy-duty milling operations — involving either high-strength alloys machined in the hardened state or ordinary metals. For example, in actual production milling operations, 5415 steel, Bhn 255-260, has been removed at a rate of 50 cubic inches per minute; and Super Tricent, Rc 55-57, has been removed at a rate of nearly 5 cubic inches per minute!

This performance is possible, because the torsional resistance of a P&W Splined Arbor with Splined Spacers approaches that of a *solid* arbor having the same OD as the Splined Spacers. In addition, the splined cutter is accurately LOCATED on the ID of the splines and is DRIVEN by the sides of all 6 splines . . . NOT by a single, soft metal key.

The greater resistance to torsional deflection reduces efficiency-robbing backlash and chatter to a minimum. Metal removal rates are increased from 92% to 400%. Cutter life is increased proportionately. Downtime and per-piece tooling

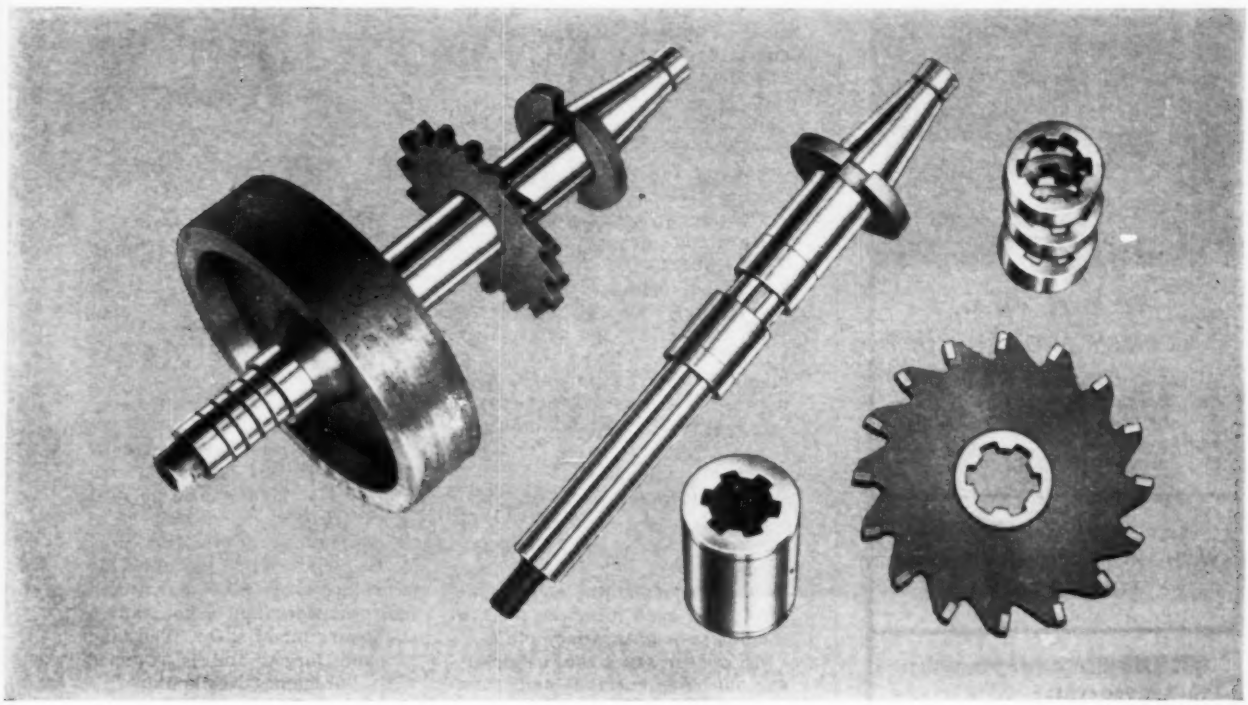
PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

ASSURED...

NEW SPLINED
MILLING CUTTERS and ARBORS



costs are greatly reduced. Equally important, P&W Splined Arbors deflect much less than conventional types, and the use of 6 splines in place of a single key slot results in a constant rate of deflection throughout the full revolution of the cutter. As a result, waviness in the machined surface is eliminated; milling accuracy and finish are greatly improved.

Finally, your present inventories of plain cutters and arbors will not be obsoleted by these new splined cutters and arbors. Conventional cutters can be used on splined arbors, and splined cutters can be used on conventional arbors, using special keys.

WRITE NOW FOR COMPLETE INFORMATION...

and see how P&W Splined Milling Arbors can help you speed all your heavy-duty milling jobs, reduce per-piece tool costs and improve work accuracy. Contact the P&W Branch Office in your area or, if you prefer, write direct. Pratt & Whitney Company, Inc., 11 Charter Oak Blvd., West Hartford, Connecticut.

TAPS • THREAD ROLLING DIES • THREAD MILLING CUTTERS • MILLING CUTTERS • END MILLS • REAMERS • KELLERFLEX BURS • KELLER CUTTERS

THE WAY TO CUT KEY WAYS

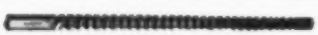
Minute Man

KEYWAY BROACH KIT

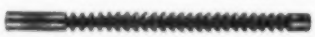
In one minute and for as little as one cent you can cut a keyway with the Minute Man Keyway Broach Kit. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

SAVE TIME AND MONEY WITH THESE OTHER STANDARD STOCK BROACHES

SQUARE BROACHES — 1/8" to 3/4" holes



HEXAGON BROACHES — 1/8" to 3/4" holes



ROUND BROACHES — 1/4" to 1" holes

SEND FOR CATALOG AND PRICE LIST

The duMont Corp.
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

duMont

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Surface-finish measurement

Dear Sirs:
We would appreciate your sending us a copy of your Special Report No. 476: "Surface-finish measurement on nonferrous materials. (*AM*—Aug 10 '59, p105) The ideas and comments given in this report by Mr Piper and Mr Callis will be of great help to our Sectional Committee on Classification and Designation of Surface Qualities, B46.

We want to call your attention to an error on page 106, Fig. 1. The number 63 shown in the symbol is the roughness height and not the roughness width. We trust you will make this correction soon.

Manuel Gutierrez, *standards engr*
The American Society of Mechanical Engineers
New York, NY

On page 117, the article says, "... a good deal of confusion can result from misinterpretation of the numbers surrounding the symbol. In some cases the roughness-width rating has been mistaken for the roughness-height rating, etc."

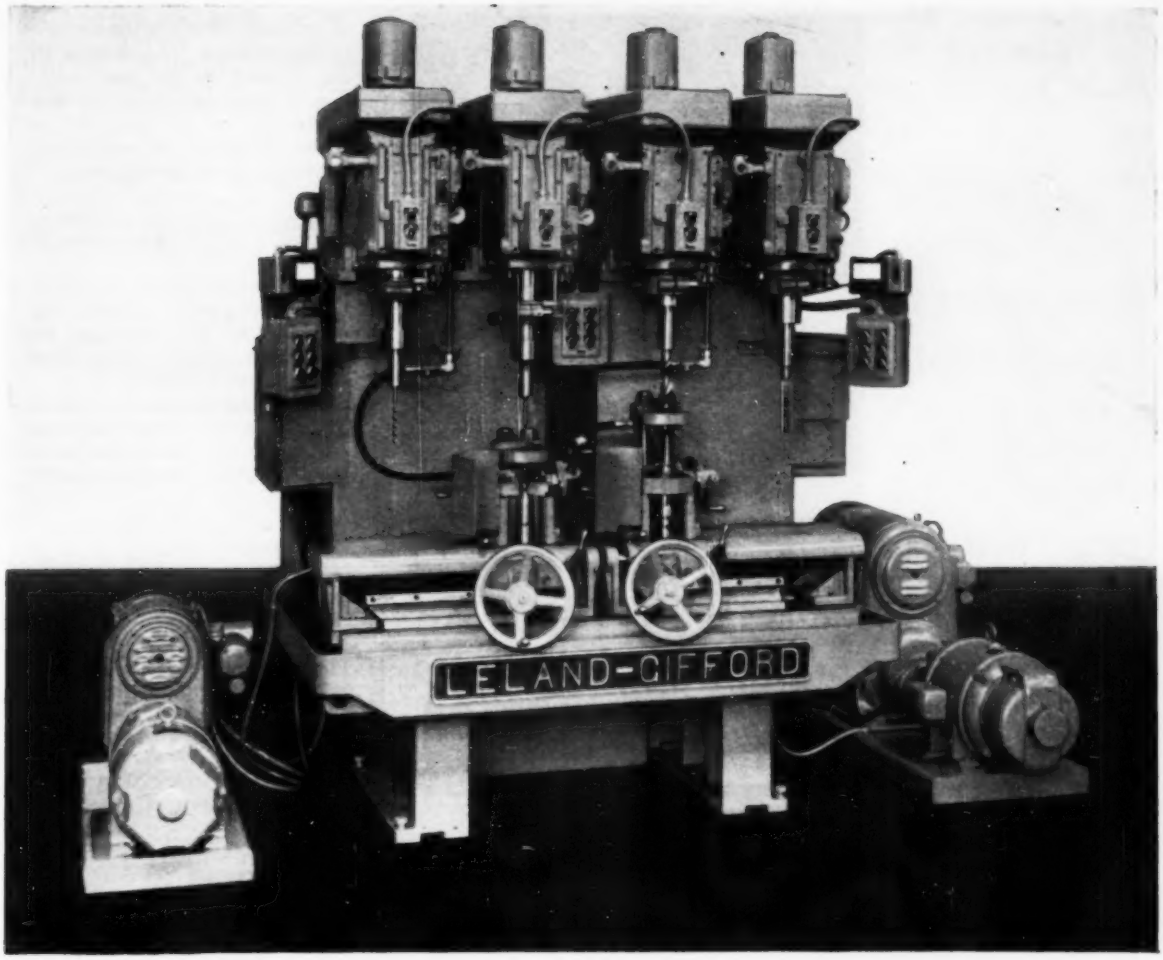
All we can say is that we pointed out the mistake—and then made it—Ed.

What is it?

Dear Sirs:
Found among some early 19th Century gunsmith's tools, this 10-in.-long tool has a cross-section in the form of an equilateral triangle, and tapers from a vertical height of 0.250 in. to 0.350 in. at the start of the radius near the shank. One side is smooth, the two other sides have sharp teeth with considerable rake and a slight amount of shear. The tang is hand forged and is stamped with the name, Newbould.

Does any reader have an idea

GOT TWO NICKLES FOR A DIME?
--LE'S SEE-- JOCKEY WEIGHS 120-- RUNS A FURLONG IN---
HUH! WHAT!! SHADDUP! CAN'T YOU SEE I'M FIGGERIN' OUT A PROBLEM ER SOMETHIN!? HOW YOU EXPECT I CAN CONSENTRATE ??!!
BUT! ON THE OTHER HAND...
--YOU BETTER GET 16 BOLTS, 1/2 BY 4 ... AN' 57 OF 'EM 3/8 BY 3 AN' A 6 INCH HUNK OF FRAMMIS 6 BY 9 BY SEVENTYELEVEN--- AN A 23 SKIDDLE DE DEE TO YOU 2 TOO--- AN' IN 2 HOURS THEY'LL BE IN THE OVEN 3 2200FER 2 IN 1 AN' QUENCH IN 3 AW'!?
N. HARVIS



Designed for maximum utilization—

It goes without saying that Leland-Gifford special drilling machines deliver the production you want to the precision standards you set. But Leland-Gifford also has in mind the importance of design for maximum utilization to make your purchase of a Leland-Gifford machine a gilt-edge, quick return investment.

For Automatic Drilling at its best . . . be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

THE JOB: Drill and ream a complete line of screw machine master collets and feed fingers ranging from $\frac{1}{8}$" to $1\frac{1}{4}$" diameter.

THE MACHINE: A dual operating Leland-Gifford special with two work-holding fixtures and four standard self-contained drilling units equipped for either plain or step feed. Workpieces are drilled in one location, indexed to second location and reamed. Spindle speeds are precisely controlled through variable frequency input to ac spindle motors. Hydraulic feed is infinitely adjustable with separate motors driving hydraulic pumps at constant speed regardless of spindle speed.

LELAND-GIFFORD SPECIAL DRILLING MACHINES

WORCESTER 1, MASSACHUSETTS
U. S. A.

Chicago 5
2515 W. Peterson Ave.

Detroit
10429 W. McNichols Rd.

Cleveland 22
P. O. Box 853

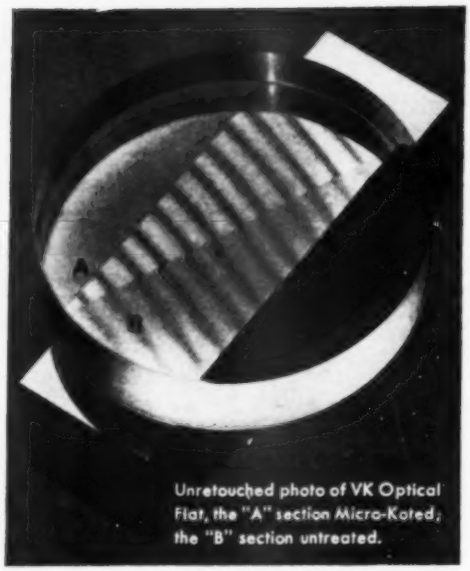
New York Office
75 S. Orange Ave.
South Orange, N.J.

Los Angeles Office
2620 Leonis Blvd.
Vernon 58, Cal.

Indianapolis 6, P. O. Box 1051

Rochester 12, P. O. Box 24, Charlotte Station

Checking surface flatness **down to 1/10 of a band?** (.000001-inch) You can do it easily with the



Unretouched photo of VK Optical Flat, the "A" section Micro-Koted; the "B" section untreated.

VAN KEUREN MICRO-KOTED* OPTICAL FLAT

Elimination of the fuzzy edges of the interference bands gives you *greater precision* and *readability*... and faster checking, too, because you get the pattern quicker. There's stronger contrast, a brighter field. The narrow band, very black and sharp-edged, has a width corresponding to a height difference of about .000001".

Having several times the effectiveness of ordinary flats, you might think that VK Micro-Koted Optical Flats are expensive — but that's where you'd be wrong. They cost only 10% to 15% more than uncoated flats. They do not require special handling; they have amazingly long life. One user checked more than 10,000 pieces of permanent magnetic material (carbon seals and Alnico seals) without any appreciable wear. Speaking of VK Micro-Koted Flats, one man said, "It makes a hell of a difference! We wouldn't buy a flat *unless* it was Micro-Koted!" That's the kind of compliment that makes us do our best!

Originated by Van Keuren in 1957, these Micro-Koted flats are perfect for checking bronze, brass and other metals used for magnetic seals, and for checking other critical parts, for surface flatness.

Write today for descriptive leaflet, "Micro-Koted Flats".

* VK Micro-Koted Optical Flats are treated on one side with a transparent layer of hard metal.

VK

THE Van Keuren CO.
Since 1920
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
... rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

as to what it is? Guesses have ranged from a file — despite the coarse pitch of the teeth—to a broach. The latter seems the more likely but, as it could not be driven completely through or past the work, a tapered surface would result.

H E Linsley
Hawthorne, NJ

As many of you know, "Jim" Linsley is a member of AM's staff. However, he has submitted this inquiry as a private individual and as a gun collector.

This thing apparently has something to do with guns, but it's not much of a collector's item unless it can be identified. Anybody care to guess?—Ed.

Portable spotwelder

Dear Sirs:
Please let me know how I can get additional information on the Triangle portable spotwelder described in "Metalworking Report" (*AM*—Aug 24 '59, p3).

R B Ziegler
Groton, Conn

As the manufacturer of this spotwelder does not yet have representation in the US, your best bet is to write him in England: Triangle Products, Ltd, Manchester Road, Hyde nr. Manchester, England—Ed.

"Well, enough of this idle chatter, let's get back to the shop and finish making up the list for the football pool."

CALENDAR

American Machine Tool Distributors Association — Annual Meeting, Oct 25-27, Statler Hotel, St Louis, Mo.

American Gear Manufacturers Association—Semi-Annual Meeting, Oct 26-28, Edgewater Beach Hotel, Chicago, Ill.

American Society for Metals—National Metal Exposition and Congress, Nov 2-6, International Amphitheater, Chicago, Ill.

National Tool & Die Manufacturers Association — Annual Convention, Nov 4-8, Statler-Hilton Hotel, New York, NY.

Industrial Management Society—Industrial Engineering and Management Clinic, Nov 5-6, Conrad Hilton Hotel, Chicago, Ill.

Metal Treating Institute—Annual Fall Meeting, Nov 6-7, Sheraton Hotel, Chicago, Ill.

National Screw Machine Products Association — Fall Membership Meeting, Nov 14-18, Americana Hotel, Bal Harbor, Fla.

International Automation Congress & Exposition, Nov 16-20, New York Trade Show Building, New York, NY.

Packaging Machinery Manufacturers Institute—National Exposition, Nov 17-20, Coliseum, New York, NY.

American Society of Mechanical Engineers — Annual Meeting, Nov 29-Dec 4, Chalfonte-Haddon Hall, Atlantic City, NJ.

Drop Forging Association—Winter Meeting of Members, Dec 6-9, Savoy-Hilton Hotel, New York, NY.

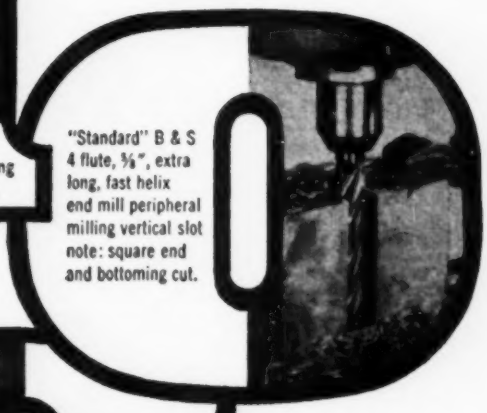
Instrument Society of America—Instrument-Automation Conference and Exhibit, Feb 1-5, Houston Coliseum, Houston, Texas.

Society of the Plastics Industry—Reinforced Plastics Div Conference, Feb 2-4, Edgewater Beach Hotel, Chicago, Ill.

American Institute of Mining, Metallurgical, & Petroleum Engineers—Annual Meeting, Feb 14-18, Statler and McAlpin Hotels, New York, NY.

"Standard" B & S 4 flute, ½", taper shank end mill cutting cam track in annealed steel.

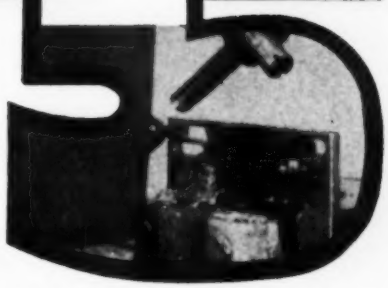
How Brown & Sharpe "STANDARD" End Mills End Wonder, Worry & Wait!



"Standard" B & S 4 flute, ⅜", extra long, fast helix end mill peripheral milling vertical slot note: square end and bottoming cut.

"Standard" B & S 2 flute, 1/16", straight shank, double end end mill cutting key slot in arbor—note: double end doubles production before resharpening.

"Standard" B & S 4 flute, ½", fast helix, double end end mill plunge cutting and slotting boiler plate.



CHOOSE FROM 1065 DIFFERENT "STANDARD" OFF-THE-SHELF END MILLS AND PRODUCE JOBS LIKE THESE—IN THE TIME YOU USED TO WAIT FOR OTHER TOOLS!

Here are just a few of the production jobs that are completed and shipped daily—ahead of schedule —by Brown & Sharpe End Mill Users.

Rely on your Brown & Sharpe Distributor for speedy service from a stock of 1065 different end mills.

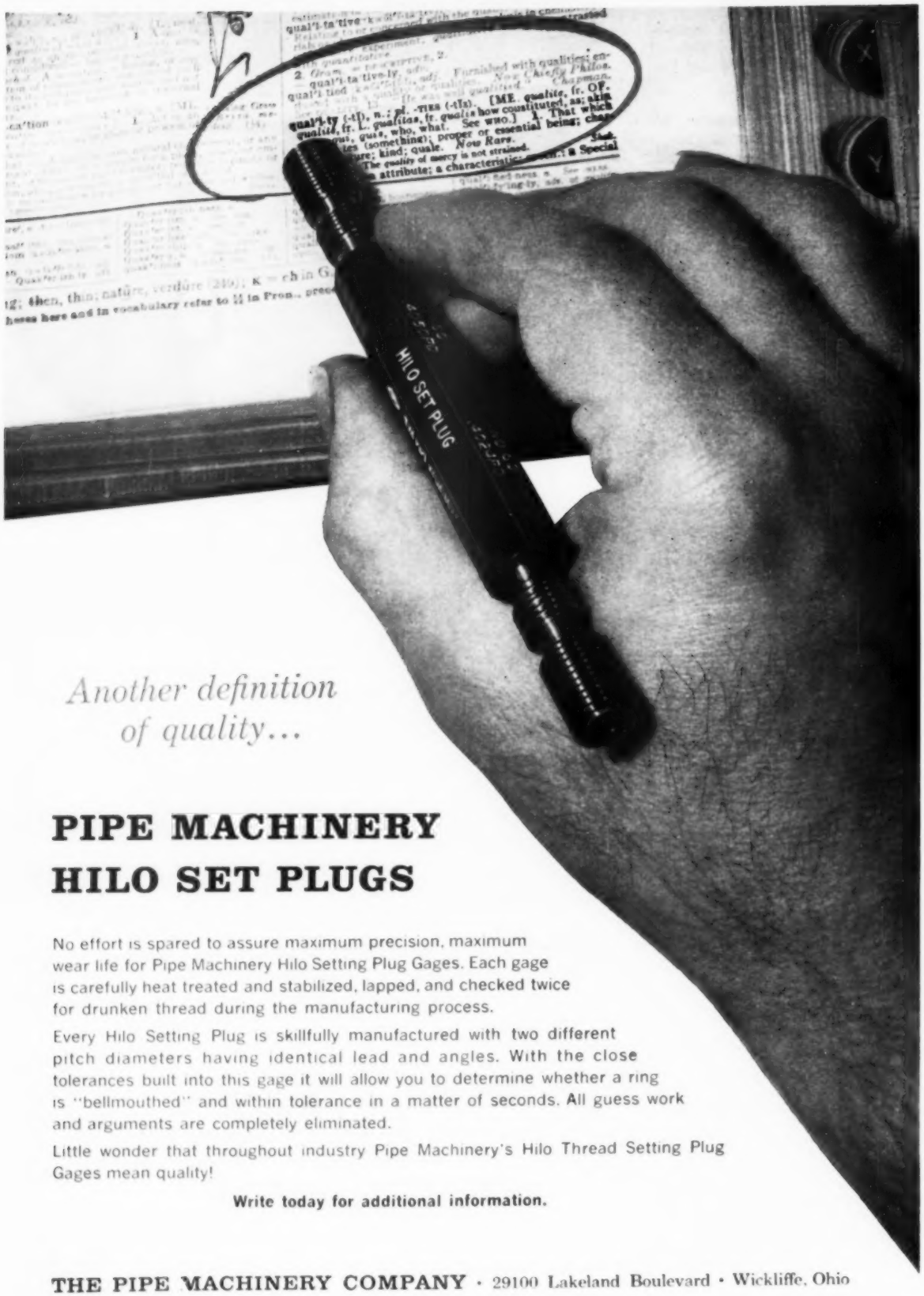
Send for the B & S "Condensalog" to: **Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.**

Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS
NELCO CARBIDE TOOLS
END MILLS

FOR THAT EXTRA EDGE IN PRODUCTION



Another definition of quality...

PIPE MACHINERY HILO SET PLUGS

No effort is spared to assure maximum precision, maximum wear life for Pipe Machinery Hilo Setting Plug Gages. Each gage is carefully heat treated and stabilized, lapped, and checked twice for drunken thread during the manufacturing process.

Every Hilo Setting Plug is skillfully manufactured with two different pitch diameters having identical lead and angles. With the close tolerances built into this gage it will allow you to determine whether a ring is "bellmouthed" and within tolerance in a matter of seconds. All guess work and arguments are completely eliminated.

Little wonder that throughout industry Pipe Machinery's Hilo Thread Setting Plug Gages mean quality!

Write today for additional information.

THE PIPE MACHINERY COMPANY · 29100 Lakeland Boulevard · Wickliffe, Ohio

CIRCLE 241 READER SERVICE CARD

CIRCLE 242 READER SERVICE CARD ►

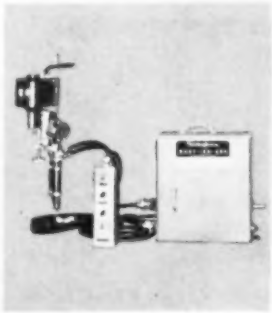
whatever you need
in welding . . .
you can count
on Westinghouse

WEST-ING-ARC AUTOMATIC WELDING EQUIPMENT

Up to 200% faster on mild steel!

Model SA-1, for semi-automatic operation. Dynamic braking permits re-striking the arc without inching or trimming wire.

Model SA-10, automatic with extreme flexibility. Includes additional relay panel and operator's remote control station.



Model SA-20, for medium-duty automatic welding. Adjustable mounting brackets permit components to be applied directly to fixtures.

Model SA-30, for semi-automatic or arc spot welding. Simple attachments facilitate all tack and plug welding.

Be sure to ask your Westinghouse Representative about the SA-130. This is the new electronic Arc-Spot timer for use with West-ing-gun

Cuts total welding costs as much as 30% (with M.I.G. welding of steel)

WEST-ING-ARC® welding equipment automatically feeds electrode wire into the arc, at a constant, preselected rate. Also facilitates arc strike, wire-inching and wire-feeding speed, and control of power, shielding gas and cooling water in proper sequence.

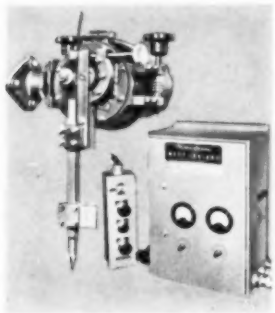
All WEST-ING-ARC welds are clean and sound, with exceptional physical properties and appearance. Fillet, lap, butt, plug and tack welds all are made with well-controlled penetration!

No abrasive flux is used. So all undue maintenance of fixtures and of materials-handling equipment virtually is eliminated!

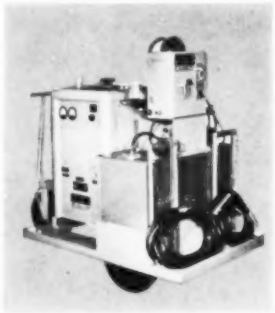
Savings of 50¢ per deposited pound! — at speeds up to 90-inches per minute! — with CO_2 gas, where applications are suitable.

There are WEST-ING-ARC units to benefit your facilities! to supply from push-button start and steady repeat operation — to all the versatility and portability of a mobile, completely self-contained, "packaged" unit!

Contact your nearest franchised Westinghouse Welding Distributor; or write to the Westinghouse Welding Laboratories, Box 2025-A, Buffalo 25, New York.



Model SA-40, for extra-heavy-duty, fully automatic operations. Readily connected to utilize CO_2, argon or submerged-arc welding.



Model SA-30P. See automatic welding on wheels! — the new, Westinghouse PORT-ARC — Model SA-30P. This same speed and economy, with mobility and ease, is applicable for WEST-ING-ARC models SA-1, SA-10, SA-20 and SA-30.

WEST-ING-GUN Cuts Welding Costs! Speeds Production! Gets Everywhere! Hard-to-weld metals now welded automatically! There is now a portable hand gun — for gas-shielded welding of aluminum, mild and stainless steels, bronze, copper and magnesium! Moreover, this hand gun has its *own self-contained wire supply!*

It is named the WEST-ING-GUN. It works with any standard d-c welding machine. It has *averaged* horizontal fillets of 22 inches-per-minute — with $\frac{1}{16}$" wire! Throughout *extensive* field tests, this WEST-ING-GUN has *doubled men's daily output!*

new . . . Silicon Type WS

200, 300, 400 and 500 Amperes
230/460 Volts
60% Duty Cycle

Silicon diodes in the three-phase, full-wave rectifier are the heart of the WS welder. These diodes have a capacity far in excess of the rating for the welder and are hermetically sealed against dust, oil, water and acid fumes by a new bonding process. Each diode is thoroughly tested before and after insertion in the bridge.

Watch Westinghouse for New Developments in Welding

Rectifier Welder

- *Maximum Performance at Minimum Cost*
- *Highest Degree of Electrical Efficiency*
- *Most Compact Welder in the Industry*
- *Extremely Low Maintenance*

The Type *WS* silicon rectifier welder reflects engineering skill of the highest order. This welder is designed for maximum performance and reliability. It is a product of experience—developed in the Westinghouse laboratories and tested in the field under a variety of conditions. The welder you purchase will be checked out in every detail before it leaves our factory. Every conceivable precaution has been taken to assure you of a faultless piece of equipment.

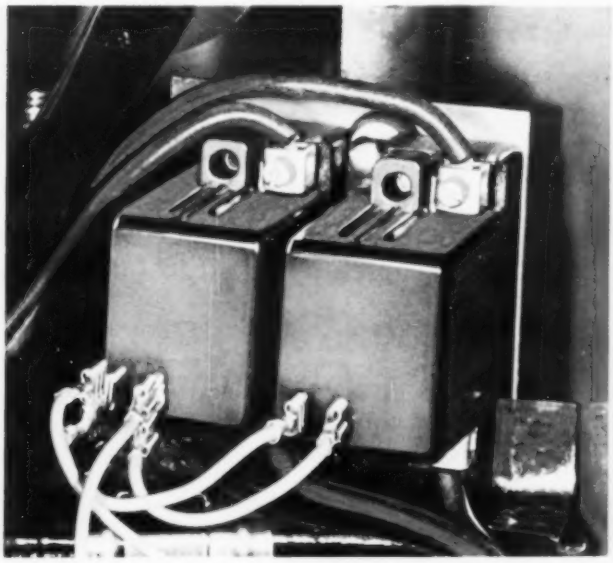
Westinghouse pioneered this completely new concept in industrial welding machines over 10 years ago. Since that time another refinement of the rectifier-type welder was achieved by Westinghouse through the use of silicon diodes. The ultimate in silicon rectifier machines is the Westinghouse Type *WS*.

No other welder on the market has the electrical circuitry to produce sound quality welds as consistently as the *WS*. It provides easier starting, arc stability and maximum drive. Silicon rectification means top welding performance.

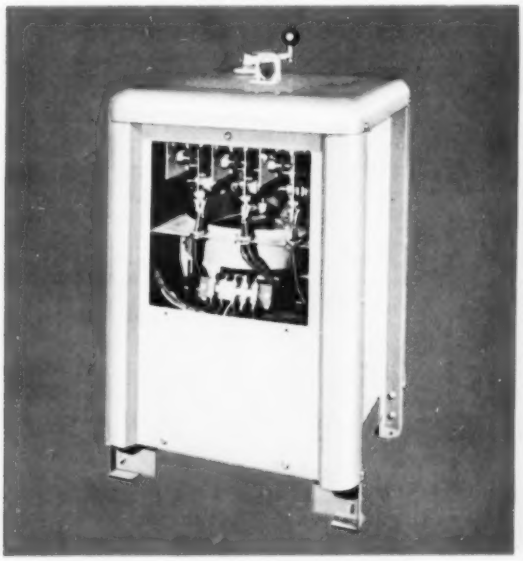
The *WS* is the lightest, smallest machine on the market. It is easy to handle and is a space saver. Its bonderized steel casing, protected by baked-on enamel, gives it a weatherproof construction. The high-quality materials in this welder will render long life and trouble-free service.

Learn more about this reliable source of power for welding!

Contact your nearest franchised Westinghouse welding distributor—or write: Welding Division, Westinghouse Electric Corporation, 4454 Genesee Street, Buffalo 5, New York. J-22150



The inverse time relay shown here allows adequate time delay for arc starting at high current setting and freedom from nuisance power interruptions—yet it protects against serious short circuit faults. Capacitors divert and store peak, high-value, short-time voltage spikes that occur when electrical current is broken.



The Type WS has virtually no moving parts to wear out; thus, replacement is at a minimum. The easy access panel shown here makes routine maintenance and air cleaning of the rectifier bridge a fast, simple operation. Be cost-wise, avail yourself of this extremely low maintenance!

YOU CAN BE **SURE**...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

A complete line of mild steel electrodes

for manual welding. Suggested applications are listed below:

AWS class	W type	Description and Application
iron powder		
E-6014 & E-7014	Zip-14	All position, high speed a-c or d-c straight polarity, and reverse polarity. For use on wrought iron, low and medium carbon steels, low alloy steels, copper-bearing steel, and low or medium carbon cast steel.
E-6024 & E-7024	Zip-24	For high speed flat position and horizontal fillets a-c or d-c straight and reverse polarity.
E-6018 & E-7018	Wiz-18	All position, high speed, low hydrogen a-c or d-c reverse polarity; for use on alloy steels, heavy plate sections.
mild steel		
E-6010	XL-610	All position, high quality d-c reverse polarity. For use on all low and medium carbon steels, low alloy and cast steels, heavy plate fabrication, shipyard, pressure piping, pressure vessels and general structural steelwork.
	XL-610A	Particularly designed for pipeline work. (See XL-610.)
E-6011	ACP	All position, high quality a-c or d-c reverse polarity. For metal application see XL-610.
E-6012	FP	All position, general purpose, poor fit-up a-c or d-c straight polarity. For use on wrought iron, low alloy steels, copper-bearing steel, and low or medium carbon cast steel.
	FP-2	All position, high speed a-c or d-c straight and reverse polarity. For metal application see FP.
	AF	Flat horizontal, and vertical applications, a-c or d-c straight polarity. For high speed fillet and butt welding of thin plate, auto frame, etc.
E-6013	SW	All position, general purpose a-c or d-c straight polarity. Use for general repair and maintenance, hopper, bin, cabinet, heating and ventilating equipment, fabrication, auto and truck work.

mild steel *(cont.)*

E-6013	SW-2M	All position, general purpose a-c or d-c straight polarity. For use on both light and heavy gauge steel fabrication and repair. Use on low and medium carbon steel wrought iron, low alloy steels, copper-bearing steel and low or medium carbon cast steel.
	SW-3	All position, general purpose a-c or d-c straight polarity. For metal application see SW-2M.
E-6020	DH	Deep-groove, flat-fillet, cover bead horizontal fillets. A-c or d-c; straight or reverse polarity. For use in general construction work, shipbuilding, roll pipe and in-position production welding.
	AB	Flat and horizontal applications with a-c or DCSP for high speed welding of light gauge plate such as auto bodies, etc.
E-4510	Sulcoat-18	All position, general purpose d-c straight polarity. For use on outdoor structures and as a filler.
low hydrogen		
E-6016 & E-7016	LOH-2	All position a-c or d-c, reverse polarity. Prevents under-bead cracking. For use on mild steel tanks and structures to be vitreous enameled, also for maintenance on steels of unknown analysis.
E-9016	LOH-90	All position a-c or d-c reverse polarity. For use in the fabrication and repair of alloyed steels.
low alloy		
E-7010	XL-710	All position high quality, d-c reverse polarity. For fabrication and repair of high pressure, high temperature piping and low alloy steel structures.
E-7011	ACP-MO	All position high quality a-c or d-c reverse polarity. For metal applications see XL-710.
E-7020	DH-MO	For flat position and horizontal fillet a-c or d-c straight polarity. For fabrication of boilers, pressure vessels, and heavy plate sections of low alloy steel plate.

Contact your nearest franchised Westinghouse Welding Distributor; or write to the Westinghouse Welding Laboratories, Box 2025-A, Buffalo 25, New York.

Westinghouse brazing materials

for economically and efficiently joining copper, brass and bronze

QUICK SELECTION TABLE—WESTINGHOUSE BRAZING ALLOYS

Alloy	Description and Uses	Nominal Chemical Composition	TEMPERATURES		Brazing Range	Standard Packaging*
			Liquidus	Solidus		
Westinghouse PHOS-COPPER RODS, WIRE, RINGS, POWDER AWS Class—BCuP-2	An economical, very fluid medium temperature, self-fluxing brazing alloy for copper. Withstands moderate vibration. Meets Specifications: • U. S. Navy (47-C-3-Mil-C-20158) • American Bureau of Shipping • Alternate for Mil. Spec. 47S13C (Mil-S-15395)—15% Silver Alloy Joint Clearance: .001" to .003"	Phosphorus: 7.25% to 7.35% Copper: Balance	1450° F to 1461° F	1310° F	1350° F to 1500° F	RODS: 36" long, all sizes 25-lb cartons 18" long, all sizes 50-lb cartons WIRE: Approx. 10-lb coils RINGS: 1000 min POWDER: 1-, 5- & 10-lb cans
Westinghouse PHOS-COPPER-5 STRIPS AWS Class—BCuP-1	A low-cost filler metal with wide melting range and low fluidity. Used primarily for preplacing in electrical connections with resistance welding or to supplement spot welding operations. Joint Clearance: .003" to .005"	Phosphorus: 4.80% to 5.20% Copper: Balance Max Impurities: 0.10%	1640° F to 1660° F	1310° F	1450° F to 1700° F	STRIPS: 15-lb random coils
PHOS-SILVER-2 RODS, WIRE AWS Class—None	A 2% silver alloy with comparable characteristics to Phos-Copper. Slightly lower liquidus temperature makes it ideal for special jobs where temperature is a factor. Joint Clearance: .001" to .003"	Phosphorus: 6.9% to 7.1% Silver: 1.80% to 2.20% Copper: Balance Max Impurities: 0.10%	1435° F to 1455° F	1190° F	1350° F to 1500° F	RODS: 36" long, all sizes 25-lb cartons 18" long, all sizes 50-lb cartons WIRE: Approx. 10-lb coils
Westinghouse PHOS-SILVER-6 RODS, WIRE, RINGS, POWDER AWS Class—BCuP-4	A very fluid 6% silver alloy for close fit-up work. Lowest melting range of all phosphorus brazing alloys makes it ideal where temperature is a factor. Joints have excellent electrical properties and tensile and shear strengths. Joint Clearance: .001" to .003"	Phosphorus: 7.20% to 7.35% Silver: 5.80% to 6.20% Copper: Balance Max Impurities: 0.10%	1310° F to 1330° F	1190° F	1275° F to 1400° F	RODS: 36" long, all sizes 25-lb cartons 18" long, all sizes 50-lb cartons WIRE: Approx. 10-lb coils RINGS: As required POWDER: 1-, 5- & 10-lb cans
Westinghouse PHOS-SILVER-6M RODS, WIRE, RINGS AWS Class—BCuP-3	A 6% silver alloy recommended for use where close fit-up cannot be maintained. Is very ductile and fills gaps and fillets without affecting strength. Joint Clearance: .002" to .005" and larger	Phosphorus: 6.05% to 6.20% Silver: 5.80% to 6.20% Copper: Balance Max Impurities: 0.10%	1450° F to 1465° F	1190° F	1300° F to 1550° F	RODS: 36" long, all sizes 25-lb cartons 18" long, all sizes 50-lb cartons WIRE: Approx. 10-lb coils RINGS: 1000 min POWDER: 1-, 5- & 10-lb cans
Westinghouse PHOS-SILVER-15 RODS, WIRE, RINGS, POWDER AWS Class—BCuP-5	15% silver alloy for use where close fit-ups cannot be made and joint ductility is paramount. Similar to Phos-Silver-6M. Meets Specifications: • Military—(MIL-S-15395) • U. S. Navy—Bureau of Aeronautics (47S-13C) • Federal Agencies and U. S. Air Force (QQ-S-5610) Joint Clearance: .003" to .005"	Phosphorus: 4.9% to 5.10% Silver: 14.8% to 15.2% Copper: Balance Max Impurities: 0.10%	1465° F to 1485° F	1190° F	1300° F to 1500° F	RODS: 36" long, all sizes 25-lb cartons 18" long, all sizes 50-lb cartons WIRE: Approx. 10-lb coils RINGS: 1000 min POWDER: 1-, 5- & 10-lb cans
Westinghouse PHOS-SILVER-65 STRIPS AWS Class—None	6% silver alloy with a wide melting range and higher melting point than Phos-Silver-6M. Its "mushy" flow makes it ideal for preplacing in lap joints particularly when ductility is required. Joint Clearance: .003" to .005"	Phosphorus: 4.90% to 5.10% Silver: 5.80% to 6.20% Copper: Balance Max Impurities: 0.10%	1575° F to 1595° F	1190° F	1400° F to 1600° F	STRIPS: 15-lb random coils

Contact your nearest franchised Westinghouse Welding Distributor; or write to the Westinghouse Welding Laboratories, Box 2025-A, Buffalo 25, New York.

Whatever you need in welding ... you can count on Westinghouse!

Only Westinghouse offers you this complete welding leadership in every kind of welding equipment.

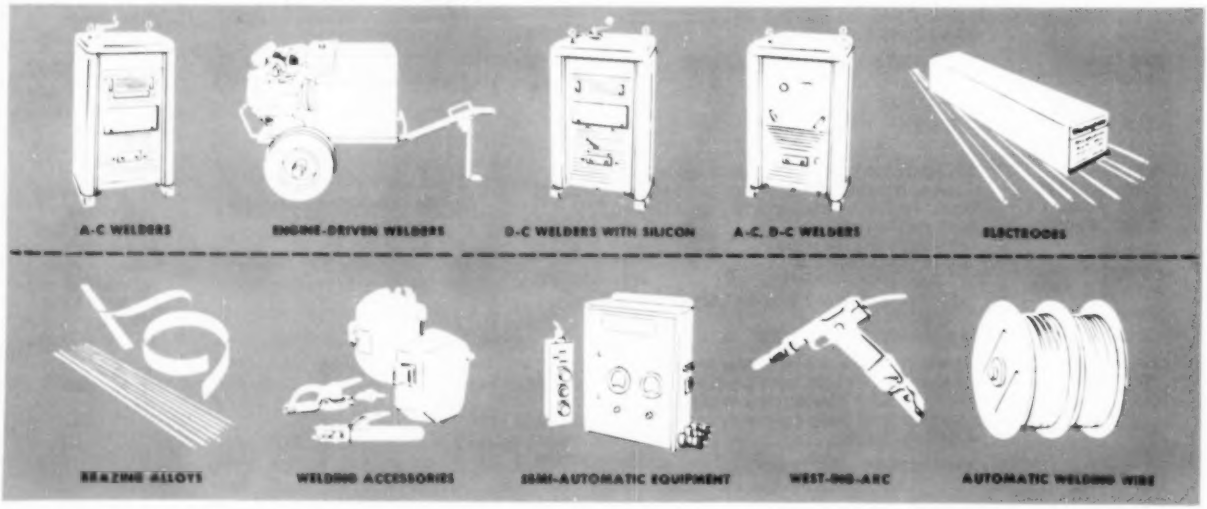
Now, more than ever before, Westinghouse has everything you need for welding. The great new line of welding supplies includes industrial a-c and d-c welders. There are new utility machines, new electrodes, new brazing alloys. Completely new automatic welders using inert gas, CO_2 and submerged arc.

Westinghouse development engineers are now working on new features ... features to assure that Westinghouse leadership in welding will continue. Features even newer than the exclusive "wide-amp" control; 100% duty-cycle arc drive; new superior core and coil construction—double-dipped and baked in silicon-fortified Bondite*; new silicon rectifier; safe, positive overload protection; and a totally-enclosed, pre-lubricated, ball bearing fan motor.

All of these were Westinghouse developments. It's evidence that only Westinghouse offers such welding leadership. For anything in welding, you can count on Westinghouse.

*Trade-Mark

Westinghouse has everything ... for welding anything ... anywhere!



Contact your nearest franchised Westinghouse Welding Distributor; or write to the Westinghouse Welding Laboratories, Box 2025-A, Buffalo 25, New York.

YOU CAN BE SURE ... IF IT'S **Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

J1-22154

SPOT NEWS...

- **Consensus among automakers** is that it will take the industry at least five months to get back to normal after the steel strike is settled.
- **ASTE is planning to change its name,** subject to member approval, to American Society of Tool & *Manufacturing* Engineers.
- **Sales of U S economy cars may reach 1-million units in 1960,** according to Ford Product Planning Manager Will Scott. His contention: the compact car will increase the number of multiple-car families.
- **Air Force cancellation of the F-108 interceptor program** has resulted in layoffs of 2000 workers at North American Aviation, with more to come. Half the workers are being laid off at North American's Los Angeles plant, the other half at its Columbus, Ohio, facility.
- **Automotive dies for 1961 models are already being processed** in Midwestern tool and die shops.
- **It cost the government $135 million** to cancel out the F8U-3 fighter aircraft project—only three planes were built and delivered by Chance Vought under the contract. They'll be used by the National Aeronautics & Space Administration as Mach 2 flying space laboratories. Navy is trying to salvage some of the cost by switching tooling to other projects.
- **Highly touted and widely advertised TV auctions of machine tools** haven't lived up to expectations, according to reports. Auction of equipment from GE's Lynn, Mass, plant, closed-circuit-televised to Boston and Chicago September 23 was disappointing because, as an auctioneer put it, "You've got to see and feel a machine before you buy it."
- **Ford engines will be in the rear on 1961 models,** according to a rumor substantiated by a number of Detroit sources.
- **New wave of investment in capital goods** by the West German auto industry is expected because German automakers chalked up enough orders at the recent International Auto Fair in Frankfurt to keep them busy for from three to nine months. GM's Opel has already announced that it intends to hire 2000 more workers to meet demand.
- **Persistent rumors** to the effect that U S tool and diemakers are facing a serious threat from foreign tool and die imports have been at least partially scotched by a National Tool & Die Manufacturers' Association informal survey of big U S metalworking firms, all in different fields. Virtually none of the queried firms buys foreign tooling, but a few get some parts from foreign sources.
- **Impact of automation on employment in California** is being studied by a committee appointed by Governor Edmund G Brown, who says that problems of retraining workers to meet radical changes in job requirements will extend back to the high school level.
- **Six Japanese firms are getting together** for joint development of guided missiles, ultimately plan to produce the ground-to-air Hawk.
- **Spin-forge machine capable of handling 96-in.-dia work 120 in. long** has just been ordered by Lockheed from Hufford. Machine will develop 650 hp at the spindle, will apply 200,000 lbs force at the rolls. Machine will be equipped to heat the mandrel up to 1000 F to shear form-heated work.
- **Journeymen machinists will get 39¢ an hour pension and pay increases** under terms of an agreement by IAM and 46 West Coast shops.

Add production flexibility the low-cost way, with EX-CELL-O UNIVERSAL FIXTURES

- Faster parts changeover
- Easier work setups
- More work from your present machines

LEFT
Hydraulically-operated cross slide of Universal Fixture supports angle plate fixture for production boring and facing.

BELOW
1 Manually-operated unit equipped with vertical slide. 2 Rotary Index Table mounts on Universal Fixture, has vernier scale for precise angular settings. 3 Installed on Style 17-A Precision Boring Machine, Hydraulic Universal Fixture increases versatility at low cost. 4 Adaptable to many operations, this Universal Fixture permits fast setup for line-boring and finish-facing work.

59-19

There's no end to the variety of boring, turning and facing jobs your Ex-Cell-O Precision Boring Machines can do when fitted with Universal Fixtures!

Designed for both short-run work and volume production, Ex-Cell-O Universal Fixtures come to you ready to mount on the machine table. Base, bracket and slides are normalized nickel-iron castings, with precision-machined T-slots and tapped holes for quick setup and accurate alignment of spindle to fixture. Work, fixtures or tools can be mounted at any position on the vertical or horizontal slide; inbuilt micrometer adjustment assures accurate setups.

Available for either manual or hydraulic operation, Universal Fixtures fit small and large Ex-Cell-O Precision Boring Machines, single or double-end models. Write today for details, or contact your Ex-Cell-O Representative.

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CIRCLE 244 READER SERVICE CARD

WASHINGTON...

Groundwork East-West trade...

First signs of an easing of East-West trade bars are showing up in the wake of Khrushchev's visit here. The Soviet Premier's new attempt to buy several Sikorsky helicopters plays up again his interest in smoothing US-Soviet trade relations.

The Soviet shopping list calls for purchases here of such hard goods as pumps and compressors, modern mining equipment, construction machinery, hoisting and transporting equipment, rolling equipment, and chemical process equipment—mostly items now under strict US export controls.

The mechanics of dismantling the barriers to trade with Russia will be complicated and the timetable uncertain. But Washington is already studying the process. How far and how fast the trade relaxations go depends on (1) Russian willingness to settle outstanding lend-lease debts to the US, and (2) whether political relations between the two countries continue to improve.

Outlook dim for military tools...

Despite the jolt provided by the Johns Hopkins Report to the Army on machine tools (*AM*—July 27 '59, p89) there's no sign of any change in Pentagon tool replacement policies. Existing military-owned production lines will remain an insignificant program, may even slide this year below the fiscal 1959 level of some $15 million in new orders.

R A Crist, the Defense Dept's production policy director, tells AMERICAN MACHINIST that the issue boils down to "the economics of the budget —you get what you need the most." And the verdict of top Pentagon policy-makers is that (1) top-priority for military procurement funds will continue to go for buying end-item weapons; that (2) tool replacement is a luxury that cannot be afforded—and when authorized will cover active production lines rather than idle ones; and that (3) breaking up and diversion of tools in packages will be stressed to build up production lines for new end-items at the expense of buying new tools where possible.

Crist estimates that roughly half the funds originally programmed for tool replacement last year were eventually spent by the Services for other procurement purposes. Still, he stresses the interest of the Pentagon's industrial experts in modernizing active production lines. Says Crist: "We are using the MAPI formula to evaluate on an item-for-item basis the production savings that could be achieved by tool replacement vs the cost of not replacing." But whether such studies will ever be implemented remains to be seen.

What's what in new labor law...

Washington is working up a program to educate employers and unions on what is required from them under the new Labor Reform Act of 1959. Detailed interpretations of the Law will soon flow from the Labor Dept in the form of "General Information Bulletins."

Both labor and NLRB plan conferences with industry and union leaders to discuss financial reporting requirements, how the new Taft-Hartley rules in the new law will be processed, and other provisions.

Meanwhile, the Supreme Court's new docket is heavy with labor cases—many of which seem to fall under the new Reform Bill rules. Several involve the issue of a union picketing for recognition when it represents only a minority of employees, others the pre-emption issue.

The Reform Bill covers both issues. It bars minority picketing, turns over to the states cases rejected by NLRB.

Depreciation liberalization...

A Republican "task force" under Charles Percy, president of Bell & Howell Co, has prepared a platform of long-range business, economic, and political goals for the party at President Eisenhower's insistence.

It provides a key to "Eisenhower Republican" thinking on a wide range of topics.

On the issue of economic growth and taxation, there's a recommendation for "some modest reduction" in corporate income tax rates and an "improvement" in depreciation allowances.

Short-range, the proposal is to "enlarge the allowance for first-year depreciation on new equipment as provided in the Technical Amendments Act of 1958." This would primarily aid companies investing in production facilities—particularly smaller firms dependent on internal funds for this purpose.

Longer-range, the proposal is that the Treasury "periodically review its depreciation schedules for all types of equipment and allow faster rates of depreciation in cases where this is clearly necessary to reflect a more rapid pace of technological change." The report says a 4% annual rise in GNP is possible—with a $900-billion economy attainable by 1976.

35% Faster with a CUT MASTER Model 75

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With their new 76" Bullard Cut Master, Model 75, the Bird Machine Company, South Walpole, Mass., is machining a 39-5/8" diameter stainless steel cylinder frame assembly 35% faster than previously, according to Mr. James Lindsay, General Superintendent.

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DETROIT...

Steel strike hurts...

Scheduled October car output may be cut by as much as 50% if steel production does not resume by the middle of the month. Even then, consensus is that it will take the industry five months to get back to normal.

Most Chevrolet plants are already on a four-day week due to steel shortages. Saginaw Steering Gear Division has furloughed about 5% of its employees and put the rest on a short work week. Ternstedt Division's Flint plant will close October 23, idling 4400 workers. Total GM layoffs across the country now exceed 12,000.

Chrysler, hit by a short strike at its Twinsburg, Ohio, stamping plant, still hopes to maintain relatively full production into November. Ford now estimates that it can continue until November 15.

Massey-Ferguson, a Detroit-based tractor builder, reports wide-scale substitution and importing. "We've had to go from one spec to another, and from one gage to another, too," a spokesman complains. "We're importing fabricated parts from Canada at about a 10% premium. Seamless tubing is the item which we find in shortest supply." M-F estimates that it will have to shut down in January even if the strike were over today. No one, M-F reasons, can stretch production below the normal working rate—it costs too much money.

A spot check of truck producers shows that most will be in trouble by the end of October. According to *Ward's Reports*, it is doubtful if the 118,000 trucks scheduled for October will be realized.

Comes the Comet...

Latest newcomer to the burgeoning list of compact cars built in America is Ford M-E-L Division's Comet. It will be sold by Mercury dealers sometime this coming spring as a 1961 model.

This 114-in. wheelbase, front-engined car will be powered by the same overhead-valve six now used in standard-sized Fords and Edsels. A 292 cu-in. V-8 will be optional. This and most probably the six will be of conventional cast-iron construction.

The basic body structure of the Falcon will be used, in two- and four-door sedan and four-door station-wagon form. Front and rear sheet metal will be extended, bringing overall length to 195 in. Width will be 70 in. M-E-L will tout it as "the aristocrat of the economy cars," so presumably it will be more costly than Ford's Falcon.

The Comet is the car that was long rumored as the Edsel "B", and later the Cougar. Introduction will be timed to match GM's forthcoming aluminum, front-engined V-8 compact car to be marketed next spring by Buick, Oldsmobile and Pontiac dealers.

The record book...

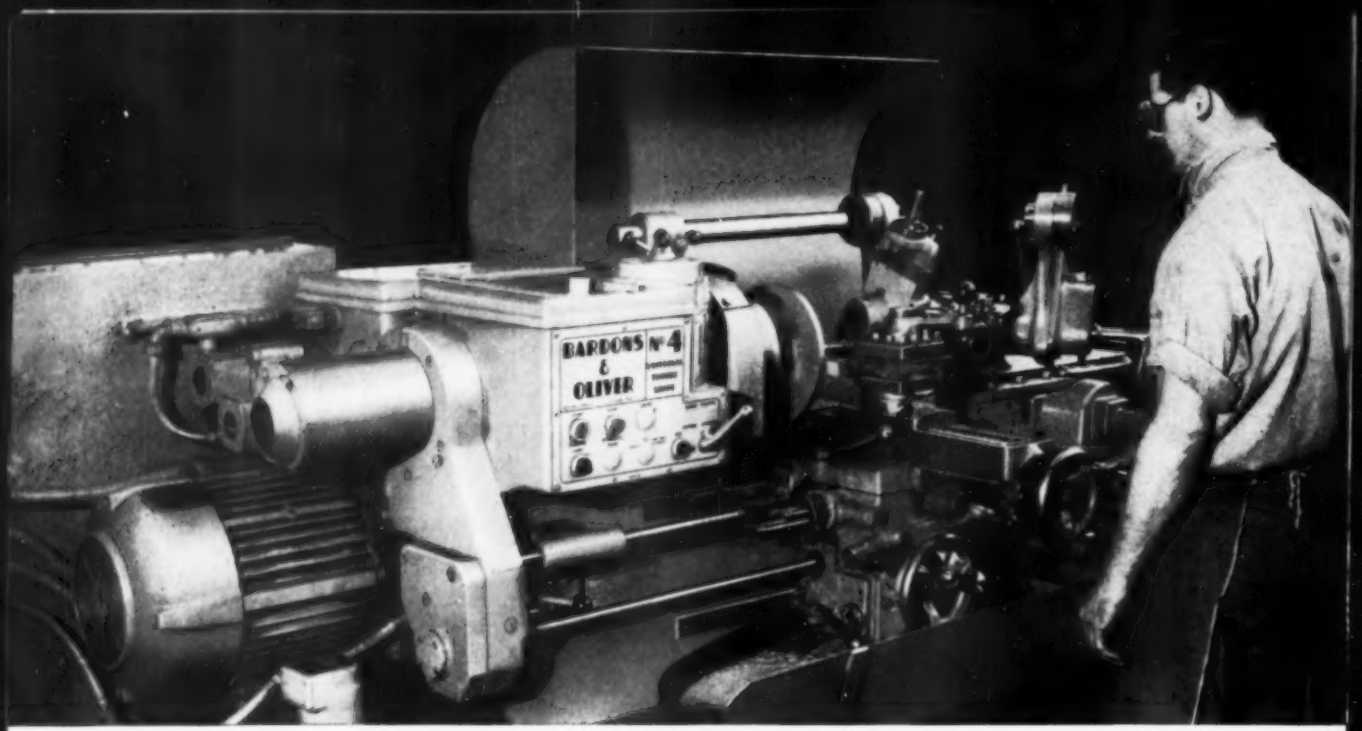
Chevrolet's new Corvair is going over with a bang even in its own home town. A spot check of Detroit area dealers shows that inventories, without exception, were sold out on the first day, leaving only a few for display and demonstration purposes. McCarthy Chevrolet, for example, received 28 Corvairs and sold 26.

It was a seller's market, with no discounting reported. Customers seemed surprised at the actual price tag, which can run as high as $2500 with a full complement of accessories. Suggested list for the cheapest Corvair (a 2-door coupe which is not yet being made) is $1810, exclusive of taxes, transportation and accessories. Ford's Falcon will bow in at $1746.

Tremendous trifles...

1960 seems to be the year for useful gadgetry in cars, usually available, of course, only at extra cost. Accolades for cleverness go to:

- Buick's adjustable instrument panel, a standard feature that permits any sized driver to set the gages for easiest reading.
- Chrysler Corp's swivel seats, which this year swivel automatically with the opening and closing of the front doors. A survey showed that owners of 1959 models were too lazy to swivel manually.
- Plymouth's almost square steering wheel, an option that gives a clear view of the road ahead for short drivers, and more stomach clearance.
- Valiant's placement of the spare tire under the floor of the trunk compartment, leaving the luggage area completely unobstructed.
- Corvair's optional folding rear seat, which transforms the sedan into a station wagon at the flick of your wrist.
- Rambler's new tailgate on wagons, which is hinged vertically like any door should be.
- Cadillac's automatic parking brake release, which uses engine vacuum to release the brake whenever the engine is started and the car put in gear.
- Pontiac's warning light, which flashes on when the gas is low.
- Mercury's instrument panel, which requires only removal of two screws for complete access to its innards. Burned-out bulbs should no longer cost $5 to replace, at least on this make.



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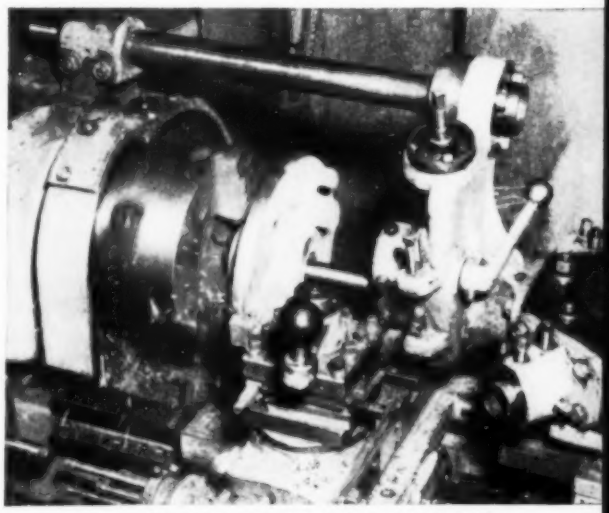

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MACHINE TOOLS...

Big press orders ahead...

Orders from the automobile industry are expected to provide a growing volume of business for both metal-cutting and metal-forming machine builders. As soon as the market for the new small cars is evaluated, Detroit will be making plans for expansion and new tooling for '61 models to be introduced in the fall of 1960.

The most exciting single program immediately ahead involves purchase of a large number of big stamping presses. One of the Big Three probably will have placed an order running into millions of dollars by the time you read this column.

Chances are that the business will go to one press builder rather than be spread among several builders.

Even more than the desire for added capacity is the realization of the automobile company that it must reequip its plants with presses of the latest design and performance (despite the fact that the company's most recent modernization program ended only four years ago).

The pending press order will be placed without waiting to find out how the small cars have fared at the hands of the public. It will be only the beginning of a buying program that will boost substantially the operating rate and the backlogs of press builders as 1960 goes along.

Detroit buying machines...

While orders from automotive sources for metal-cutting machine tools do not rival those of a few years ago, they add up to the highest total in two years. Available machine tools for rebuilding owned by carmakers have been pretty much used up and most of the machines ordered from here on are likely to be new. Some large transfer equipment still is being rebuilt for Buick, Saginaw Steering Gear and other auto firms for machining new parts where old parts have been discontinued.

Ford has a tooling program for tractors that is reported about to be placed.

Certain machine tool builders are now rebuilding machines for Chrysler of Canada.

Russia inquiring for tools...

One of the by-products of Mr K's visit has been a number of individual inquiries made by Amtorg to U S machine tool builders for delivery to Russia. At least one of the inquiries involved up to 20 machines.

Some builders are reported to have shown complete disinterest in these inquiries. Other builders have raised the point: What is Washington's attitude toward shipment of U S machines to the Soviet Union? Will export licenses be granted for machines not on the shipment-forbidden list?

There is believed to be no hard-and-fast answers to these questions. Department of Commerce, which grants export licenses, has discouraged applications for licenses. It has done so, it is said, mainly by surrounding the matter with a dense fog making it difficult for a builder to get a clear-cut "yes" or "no" answer to questions.

Two or more U S machine tool builders have recently sent top sales personnel to Moscow to explore possibilities of securing Soviet business.

Meanwhile some West German builders are working on sizable orders for delivery both to Russia and to Red China.

Kellers to be made in U K...

Pratt & Whitney Co Inc, West Hartford, Conn, and Alfred Herbert Ltd, Coventry, England, have reached an agreement to form a new company, Pratt Whitney & Herbert Ltd, which will build P&W's Keller machines at Alfred Hebert's plant. At first only one size of machine will be produced, but later on production will be expanded to a wider range of sizes.

This new set-up will enable Pratt & Whitney to compete better in world markets.

At least three other U S machine tool builders are in varying stages of negotiation with European production facilities as their objective.

National Acme further diversifies...

National Acme Co, Cleveland, has bought the Shalco Corp, Palo Alto, Calif, maker of shell core and shell molding machines and related production foundry equipment, which will be operated as a wholly-owned subsidiary.

Manufacture of Shalco standard shell core machines is being started at National Acme's No. 2 plant in Cleveland, with December 1 as the target date for shipment of the first machine. Deveolpment of new and special machines and auxiliary equipment will continue in Palo Alto for the present.

Herbert von Wolff, Shalco sales manager, has been appointed manager of the National Acme's Shalco Division. Professor Frank Shallenberger of Stanford University, president of Shalco and head of the group that founded it, will continue as consultant.

Acquisition of Shalco extends National Acme's diversification to five divisions.

B.F.

◀ CIRCLE 247 READER SERVICE CARD

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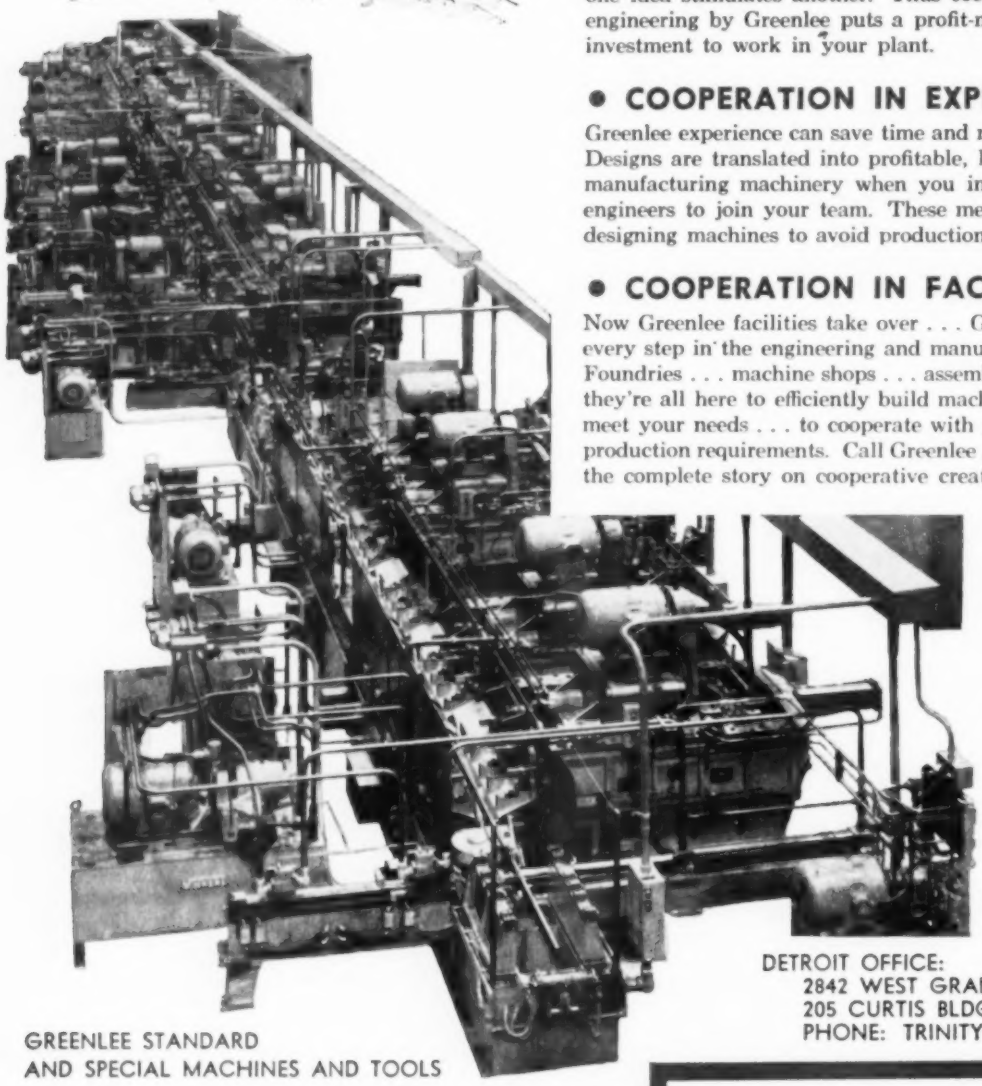

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AIRCRAFT and MISSILES... TRENDS

Feuds hamper space program...

The latest Soviet moon shots have underscored the US lag in the space race—a lag which many experts doubt has been shortened in the two years since Sputnik I.

The Soviet lead in space is generally credited to Moscow's head start and bigger budgets, factors which the US can not easily offset. But as many observers see it, there's another ingredient in the US failure to make faster progress in the space program: the persistent squabbling between the military services and other Pentagon agencies and between the Defense Dept and civilian agencies over control of projects, policy objectives, technical approaches, budget allocations, and coordination of efforts.

The administration has taken some strides in clarifying lines of authority and responsibilities among all the bureaucrats engaged in space projects. But so many agencies still have a hand in the conduct of the overall program that considerable time, money, personnel, and other resources are devoted solely to matters of coordination—lining up authorizations to proceed on projects, clearing decisions, selling proposals, and the like.

The effect of all this: continual delays in getting on with the job at hand, delays which are not tied into the more obvious bugaboos of technology and money.

Playing down ARPA in space...

Washington has just taken one big step which should help alleviate the situation. A Pentagon shakedown has removed the Defense Dept's Advanced Research Projects Agency from the bureaucratic chain of command over military space projects.

The Air Force has been assigned full control over development of the Midas early-warning and Samos reconnaissance satellites. Later on, it will also get complete responsibility for development, production and launching of all rocket boosters for military space; space transportation projects; and the Discoverer experiments on recovery of space vehicles.

The Navy has been assigned full control over development of the Transit navigation satellite and the Army over the Notus satellite-borne communications system. But one sore spot remains: both services will have to turn to the Air Force for launching their specially-designed satellites.

Pentagon vs NASA...

In effect, the Pentagon has reshuffled the $307-million military end of the overall government space program.

The new switch in responsibilities, however, will involve no major contract changes. For the most part, ARPA has farmed out operating tasks and contract administration on military space projects to the three Services.

ARPA will remain in business, limited to "advanced research" in materials, solid propellant rockets, scientific problems related to ballistic missile defense, and other non-engineering fields. Presumably this covers areas in which the three Services are not now doing research.

The shake-up does not affect the $500-million worth of purely scientific space projects of the National Aeronautics & Space Administration. NASA, which had already assumed from ARPA control over so-called "purely scientific" space projects, will remain in charge of scientific earth satellites, lunar probes, deep space probes, and other astronautic projects which have no direct tie to weaponry.

Included under NASA's wings are the projects to develop the 1.5-million-lb-thrust, single-chamber rocket (North American Aviation) and other giant propulsion systems.

Argument on U S Space Lag...

This neatly packaged distinction between the Pentagon's space weapon projects and NASA's scientific programs reflects the administration's pat response to the critical barrage about the Soviet's growing lead in space.

The administration's claim is this: that in the purely military aspects of space—notably the launching of accurate and reliable 5,500-mile ICBMs—the US is on a par with Russia. Both countries now have "initial operating capability." While Russia has perfected far more advanced rocket propulsion systems—an engine producing at least 600,000 lbs of thrust vs our 360,000 lbs (the Atlas ICBM)—Washington's official argument is that the smaller rocket is all that's needed for the military mission of propelling an ocean-spanning missile.

In line with this argument is the effort of administration spokesmen to minimize the military significance of Russia's awe-inspiring rocket shoots to the moon—an effort which infuriates many political and scientific observers.

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MATERIALS...

Vacuum-coated steel...

Vacuum coating holds great potential as a method of applying protective coatings to high-strengh steels, according to Morton Gilbert, product specialist for F J Stokes Corp, Philadelphia. According to Gilbert, the vacuum technique, unlike electrolytic methods, produces no hydrogen embrittlement to cause delayed failures in stressed high-strength parts.

Electrolytically deposited cadmium is an inexpensive, lightweight protectant for steel. But operational, and even hangar, failure of parts has been traced to its use. Vacuum-coated cadmium is expected to eliminate this hazard. Stokes has sold its first batch units for depositing heavy coats of cadmium and other metals on steel to Standard Pressed Steel Co, Jenkintown, Pa and The Martin Company in Baltimore. This area of vacuum development, the company believes, offers a substantial industrial payoff.

Both Stokes and National Research Corp, Cambridge Mass, have also developed equipment for vacuum plating aluminum on steel—important for aircraft, structural and a variety of other products. Costs are considered competitive with other processes. The ductile, non-porous coatings may be anodized and colored to produce decorative effects.

Research is overcoming a major handicap to large-volume industrial uses: lack of a sufficiently durable device to hold molten aluminum over the long (12 hr or more) periods of time required for practical continuous operation. The problem, both Stokes and NRC claim, is licked—but neither firm will tell how. Typical coaters are fed aluminum wire which melts and vaporizes in a resistance-heated "boat." Untreated carbon erodes quickly. Adding zirconium or hafnium to either the boat or the wire extends the boat's endurance. Titanium, too, inhibits formation of aluminum carbide which slows vaporization.

Borolite Corp, a subsidiary of Firth-Sterling in Pittsburgh, has developed a variety of heater (boat) shapes using its titanium boride XT-5. One heater 5 in. long, $\frac{1}{2}$ in. wide and approximately $\frac{3}{8}$ in. thick, operating by resistance, will vaporize 3 pounds of aluminum in a period of time, from 6 to 12 hr, varied according to the rate of vaporization desired. Crucibles of XT-5, up to 3-in. dia, are also available for induction-heat sources.

Lack of high-rate evaporation sources, particularly to continuously coat aluminum, have been a limiting factor. George Bancroft, manager of Consolidated Electrodynamic's (Rochester, NY) new-product development says his firm has recently been working on sources that will handle several pounds of aluminum per hour. The company is applying bright coatings of aluminum continuously to plastic and paper web materials, coatings heavy enough to be virtually opaque, at speeds in excess of 2500 fpm.

Photoelectric control tape...

Adhesive bonded, of aluminum foil and Mylar, a new photoelectric tape developed by the Dobeckmun Company, a division of Dow Chemical Co, in Cleveland, is fully opaque, unaffected by temperature and humidity changes and also has extremely close dimensional stability. Intended for numerical control, prepositioning relay circuitry, or as a tape templet, the tape offers a stable information media in the control of turret lathes, plus drilling, boring, contouring and other processes using photo electric or other perforated tape systems. The material is said to be unaffected by grease or oil, or by hundreds of start-stop cycles. It is not intended for use where direct electrical contact is made through perforations.

Lead-bronze bearings...

Casting bronze-lined bearings is difficult when the bronze has a high lead content. Czechoslovakian engineers claim they are solving the problem in two ways. In one method they sprinkle lead-bronze powder onto a sheet of copper-plated steel and sinter the material, in a reducing atmosphere, at 1470 to 1650 F for 15-30 min. Pressing and sintering are repeated to produce a high density sliding surface and good adhesion. Lead-bronze grains average 0.002 in. dia, the maximum size being 0.006 in. Bronze-faced steel sheets are formed into bearing sleeves.

An alternate method is to roll a mixture of copper and lead powder, sometimes including graphite, into a homogeneous sheet and presinter it at 1380 to 1560 F. With a maximum grain size of about 0.002 in., the strip is originally rolled 0.012-0.020 in. thick, then rerolled to densify and smooth the surface. The strip is cut into lengths, which are alternately placed on copper-plated steel sheets to form stacks, interleaved with paper to prevent adhesion. Joining is done by compressing each stack at 140 psi pressure and sintering at 1300-1400 F. The material is stamped to size and finished with diamond or ceramic tools at 600 to 1000 sfpm.

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WHAT'S AHEAD... in Metalworking

TRENDS

As the cupboard gets bare...

Shutdowns and cutbacks are the order of the day as plant after plant falls victim to increasingly acute shortages of steel. Hardest hit are the mass-production consumer goods industries, but even such basic metalworking industries as machine tools and foundries are feeling the pinch.

Even the biggest companies (General Motors for example) are not immune—are laying off workers, cutting back workweeks, or in many instances shutting down lines and plants.

The situation is bound to get worse before it gets better. Even with an 80-day Taft-Hartley grace period followed by a quick settlement, it will take the mills many months to fill pipelines.

By even the most conservative estimate, it will take well into first quarter 1960 before steel inventories hit normal levels.

In consequence, a gray market in steel is flourishing. Hot-rolled sheet and plate is bringing about 5¢ a pound over normal, and it's fast disappearing even at these prices.

One major home appliance manufacturer, which had been paying something like $200 a ton for gray market cold-rolled sheet, has had to stop—simply because it can't pass on the extra cost to the consumer in its competitively priced field.

Not only that, the price of this same cold-rolled sheet on the gray market is now $235 a ton, plus shipping and transportation costs of $25 a ton. One railroad car manufacturer recently found itself in a strange position: it had car orders for which it had no steel, and steel for which it had no car orders.

This strike stockpiling of the wrong types of steel has led to a lot of swapping among various types of metalworking firms in the last few weeks. Less affected by the steel shortages than the manufacturers of consumer goods (autos and appliances principally) are makers of capital goods, and metalworking's service industries. But even these are feeling its effects indirectly.

Machine tool manufacturers, for example, report a slowdown in new orders—largely psychological, because machine tools ordered now probably wouldn't be ready for delivery until the shortages were over anyway.

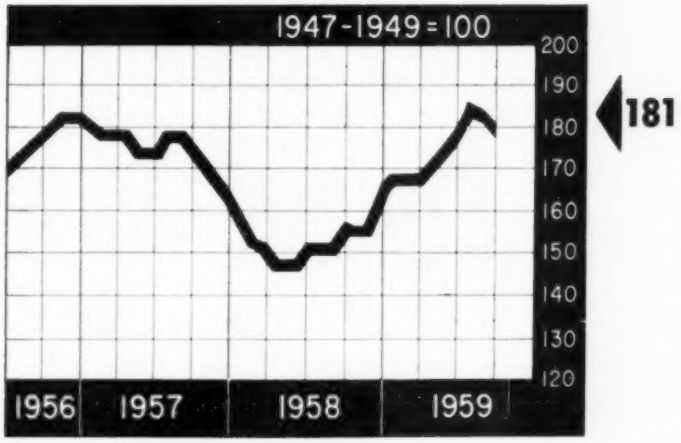
General metalworking job shops are having some stretchouts, not so much because of their own shortages of steel, but because customers are requesting long postponements on delivery.

Stamping shops are faced with "endless maneuvering" to avoid shutdowns. Substitutions and bartering are common as management tries to make the best use of critically short material.

Oddly enough, however, metalworking plants seem reluctant to take advantage of foreign steel coming in through the St Lawrence Seaway. Primary reason seems to be "If you order any really big quantity now, you wouldn't get it until next March or April anyway."

It looks as though early November will see wholesale shutdowns of production lines in many fields, particularly those with mass-produced products.

Even the steel people themselves cannot predict with certainty just how long it will take to get steel levels back to normal. But one thing is sure, steel won't be in free and easy supply for the rest of this year.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

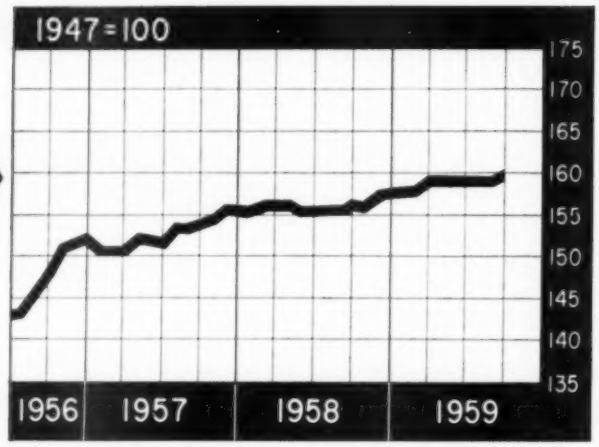
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEPT Estimated	AUG Preliminary	JULY Revised	AUG Year Ago
Total Index	**181**	**183**	**186**	**156**
Machinery	156	156	126	
Electrical Machinery	222	226	188	
Autos	135	142	76	
Other Transportation	355	351	381	
Other Metalworking	154	159	137	

TRENDS WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	SEPT. Estimated	AUG. Preliminary	JULY Revised	AUG. Year Ago
Total Index	**159.6**	**159.4**	**159.3**	**155.8**
Metalworking Machinery	187.8	185.6	180.8	
Other Machinery exc. Electrical	171.2	171.1	165.9	
Electrical Machinery	162.4	162.5	159.1	
Fabricated Metal Products	148.5	148.6	146.2	



Where is consumer credit heading?

Total consumer credit outstanding has risen at a rapid rate since the beginning of the year. By the end of August it reached a record level of almost $48 billion. The current rate of credit buying is running about 30% above last year, and could send outstanding consumer credit over $50 billion by yearend.

More people are using credit than ever before. Surveys made by the Federal Reserve Board earlier this year showed that only 40% of all families had no debt. In contrast, 10 years ago 67% had no consumer debt.

Installment payments, too, are at a record level. Repayments of consumer loans now amount to more than 13% of income after taxes—higher than in 1955 when liberalized credit led many consumers to buy a record amount of big ticket items such as cars.

Rising consumer income is the big factor behind the upturn in credit buying. Consumer outlook is much rosier than a year ago, so many families are buying goods they felt they couldn't afford during the recession of 1958.

Durable goods sales benefit most when consumers turn to credit buying. About 65% of all new cars bought during 1958 were purchased on credit. More than half of all sales of major household buyers were financed by instalment credit. Although this year's car sales won't be near the 1955 record, the amount borrowed to finance car purchases will be higher.

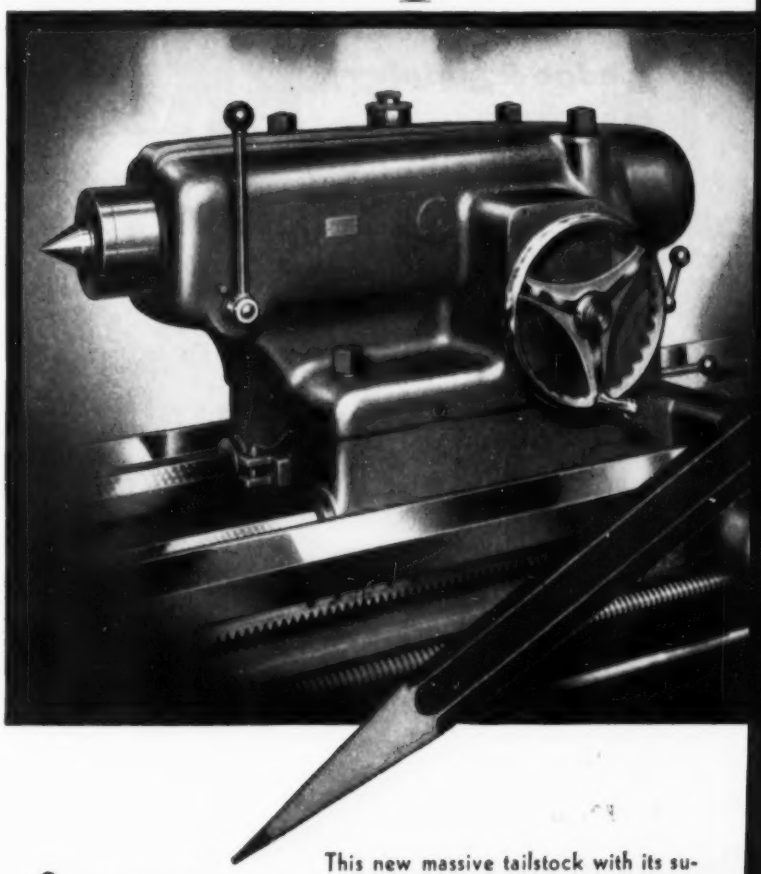
Net borrowing (how much more consumers are borrowing than they are repaying), however, is below the rate for 1955, chiefly because consumers are repaying debts at a more rapid clip.

Higher incomes this year put consumers in a better position to repay instalment loans. As in the past, consumers are likely to continue to borrow to buy the goods they want until repayments begin to equal wages. The rate of borrowing will then ease. But there is no cause for alarm in the present rise in credit buying.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	145.7	146.6	135.1
Steel ingot operations (thousands of tons)	365	362	1,933
Electric power output (million Kilowatt hours)	12,878	12,779	12,342
Production of automobiles and trucks	103,527	91,341	34,464
Engineering construction awards (Eng. News-Record—millions)	$241.5	$408.4	$353.1
QUARTERLY BUSINESS INDICATORS	**Latest Quarter**	**Preceding Quarter**	**Year Ago**
Gross National Product (billions)	$484.5	$470.2	$434.5
Expenditures of new plant and equipment (millions)	$ 32.5	$ 30.6	$ 30.3
Profits after taxes in primary iron and steel industry (millions)	$552	$374	$199
Profits after taxes electrical machinery industry (millions)	$296	$246	$195
Profits after taxes in motor vehicles and parts industry (millions)	$592	$523	$150
Profits after taxes machinery (except electrical) (millions)	$400	$223	$237
Motors and generators new orders index (1947-1949=100)	164.0	155.0	135.0

* Seasonally adjusted

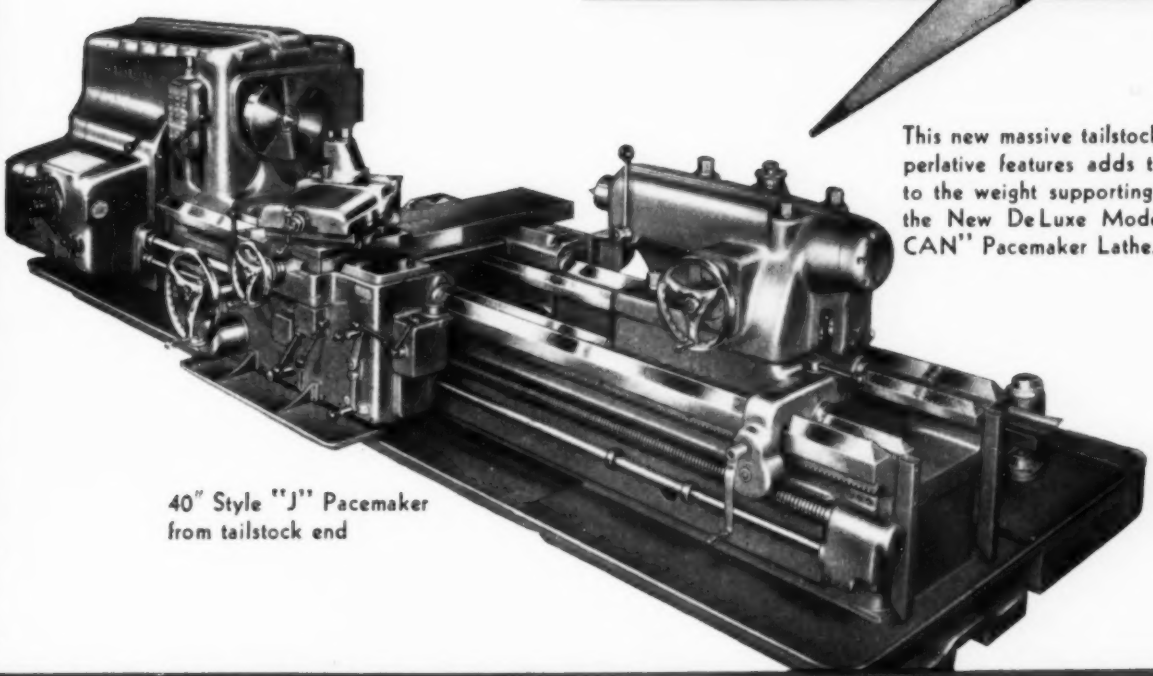
STOP LOOK Compare



This new mammoth SUPER TAILSTOCK now furnished on "AMERICAN" De Luxe Model 32" Style "I" and 40" Style "J" Lathes has . . .

- 7½" Diameter Spindle—Long Travel
- Unparalleled Rigidity
- Circular Depth Dial—Easily Read
- Built in Single and Two-Speed Types
- Convenient Front Controls
- Either Stationary or Ultra Capacity Built-in Anti-Friction Center
- Both Manual and Power Movement along Bed
- Plunger Pump Oiled including Bed Ways

Send for Bulletin No. 144 for complete details.



40" Style "J" Pacemaker from tailstock end

This new massive tailstock with its superlative features adds tremendously to the weight supporting capacity of the New De Luxe Model "AMERICAN" Pacemaker Lathe.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

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- NEW . . . Quad-lateral Ram Slide Bearing, full-length, full-time
- NEW . . . Ready-Pivot Ram Adjustment for out-of-parallel operations
- NEW . . . Dovetail, Double Rocker Bed-Mounting on solid steel housing
- NEW . . . "Long Operation" standard controls for versatile operation
- PROVED . . . One-piece, heat-treated, machined and ground Eccentric Shafts
- NEW . . . Micro-Fog, oil bath and grease Lubrication System
- PROVED . . . Two full bearings on each eccentric shaft
- NEW . . . Sectional die clamps on ram nose open automatically
- NEW . . . Stroke Position Indicator shows top and bottom dead center
- NEW . . . optional Two-Speed Transmission can be field-installed

Available in 120 through 250 ton capacities; bed lengths from 8 to 14 feet. Shown is Model Series 150A10 capacity 1/4" x 10' with above-the-floor bed.

New and completely redesigned, Lodge & Shipley Power Press Brakes offer feature after feature important to accurate, low-cost operation. Virtually every one of these advantages are included in the low base price . . . extras on the machine, but *not* on the invoice and many of the models now have an above-the-floor bed!

Space limits us to a bare listing of important new features. Request your copy of the New Condensed Press Brake Catalog today. The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

SEE OUR CATALOG IN SWEET'S

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American Machinist

THE MAGAZINE OF METALWORKING MANUFACTURING • ESTABLISHED 1877

Price of Survival

Competition from European manufacturers is causing concern not far removed from panic among many metalworking companies.

The competition is triple-edged. It involves the unpalatable prospect of losing important business here at home. It means surrendering ground to Europeans in their own home areas. It embraces stepped-up and successful sales efforts by Europeans in third markets, such as Latin America.

This critical situation . . .

has been long in the making. In the early postwar years Washington, by providing financial aid, helped rebuild the shattered economies of western Europe. It also encouraged growth of world trade by Europeans.

In 1949, with our blessing, the major European nations devalued their currencies. They thus made their products less expensive for export. Conversely, U S products became more expensive in Europe.

Western Europe, including Britain, has never had it so good. Its industrial production rose almost one-third from 1953 to 1957, and now is up still more. At the same time, output per manhour in the corresponding years went up 31% in France, 29% in West Germany, and 13% in Sweden (whereas ours gained only 9%).

Europe's labor rates . . .

are about one-third ours. In any product requiring much labor content, the Europeans have a big advantage in costs.

That is not all. Many of our manufacturers refused for years to build what customers wanted. They made customers take what was produced or go without. What an open door for the Europeans to walk in—with small cars, small tractors, and simple, low-priced machines!

Sounds depressing, to be sure. But it is no time to give up. The situation is not hopeless. You can do a lot to make it better. There is, however, no quick and easy way out of our three-horned dilemma.

One alert machinery builder has come up with a three-point program as a solution. He strongly advocates: 1) replacing your obsolete equipment and thereby increasing your output per manhour and decreasing your cost per piece; 2) redesigning your product for greater productivity and lower costs; and 3) studying your markets to see whether the bugaboo is not foreign competition but declining usefulness of your product because fast-moving technological changes have obsoleted it.

If you are bedeviled by serious foreign competition, this program is worthy of close examination. You can strengthen your own position by adopting it in whole or in part.

You should go even farther . . .

You should look into the feasibility of establishing production facilities overseas. Such facilities may be necessary if you are to compete successfully in world markets. Many metalworking companies already have made such arrangements in western Europe and other manufacturers have agreements in the making.

But above all other considerations, if you are to maintain and expand your competitive position both at home and in world markets, you should apply to your own personal situation the principles set forth recently by Frederick V Geier, chairman of the board of the Cincinnati Milling Machine Co.

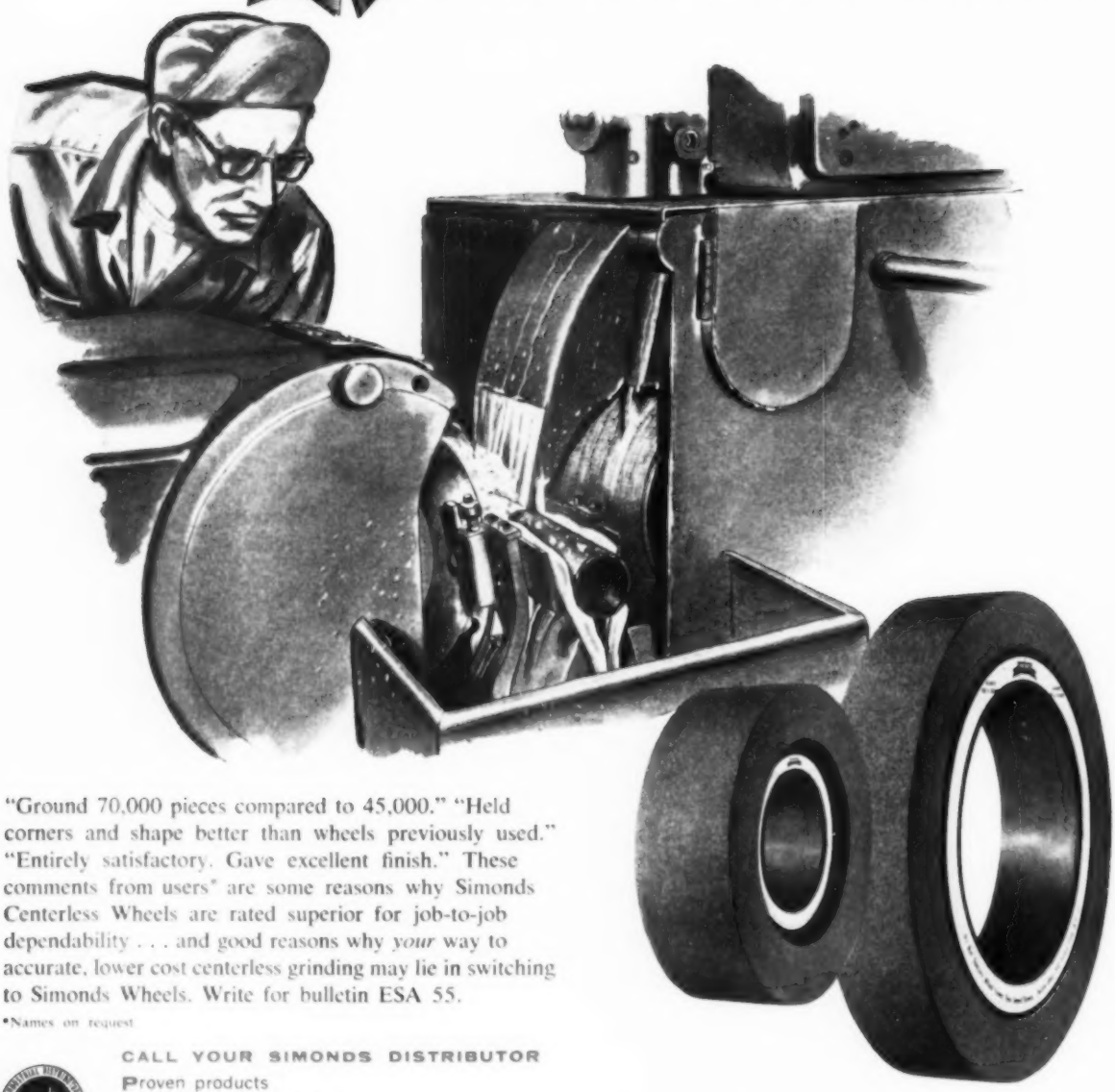
"The United States dare not lag in the swift advance of science, technology and industry," Mr Geier said. And then he added, "Excessive costs can put the monetary price of survival beyond our nation's reach."

Burnham Finney EDITOR

TOP RATED

for fast, free-cutting...high production...long wheel life

SIMONDS WHEELS FOR CENTERLESS GRINDING



"Ground 70,000 pieces compared to 45,000." "Held corners and shape better than wheels previously used." "Entirely satisfactory. Gave excellent finish." These comments from users* are some reasons why Simonds Centerless Wheels are rated superior for job-to-job dependability . . . and good reasons why *your* way to accurate, lower cost centerless grinding may lie in switching to Simonds Wheels. Write for bulletin ESA 55.

*Names on request

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Underwater "Lightning"
sparks new metal forming process

Man-made lightning, or high-energy spark-discharge, packs the wallop to form sheet-metal parts in 40-millionths of a second. Process is safe, predictable and capable of use right in the shop

By Rupert Le Grand, senior associate editor

Metal can be "moved" instantaneously—bulged, formed, or drawn—if subjected to a high-energy shock wave. Explosive forming is one means of doing this. Now we have a rival method—underwater discharge of a high-voltage spark.

"Spark Bomb"

Engineers in the Manufacturing Research & Processes Dept, Republic Aviation Corp, Farmingdale, N Y, have created the "spark bomb". This device stores up electrical energy in high-voltage capacitors, and releases that energy in 40 millionths of a second, across a gap between electrodes submerged in water in a die. The "explosion" is complete with lightning flash and thunderclap. The resulting spark creates a shock wave in the water to do the forming work. High-tensile materials and those that do not lend themselves to forming readily can be shaped instantaneously to a die cavity without fracture.

For In-Plant Use

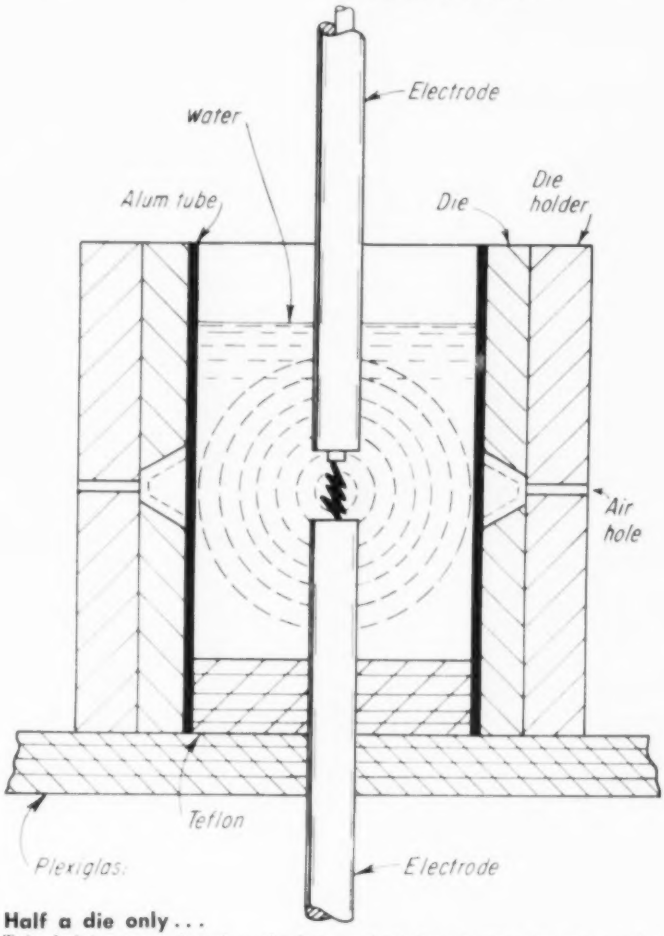
Most work with explosive forming, using actual explosives, has been done in special outside pits or structures. The spark bomb can be used in the plant, in a production line if desired, with complete safety to personnel.

Lower-Cost Machines

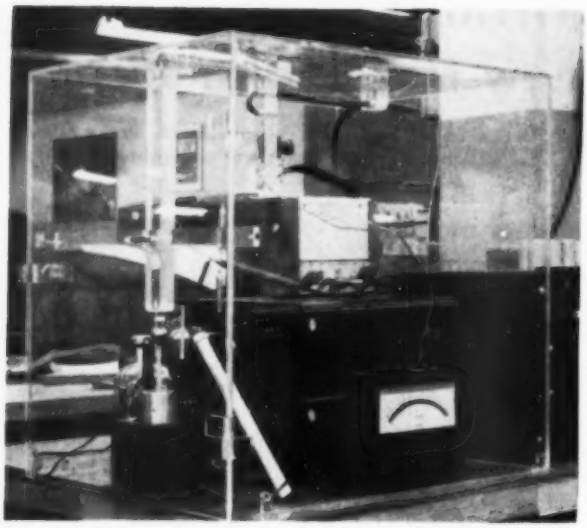
"Republic is working toward development of the device as a standard machine tool to replace more costly conventional presses," said Adolph Kastelowitz, director of manufacturing research. The process has been proved with laboratory equipment (shown). Much development work remains to be done, but it is expected that in the next several years a machine capable of handling large forming work will be developed. In the meantime, Republic will build a production machine that will do the work of a small size press. Conceivably, this machine will have a rating of 5400 watt-seconds, or three times that of the laboratory machine. This production machine will have sufficient energy to burst

Free formed . . .
Aluminum tube 0.06 in. wall by 2½ in. dia by 2 in. long, bulged ⅝ in. on the diameter in experimental equipment

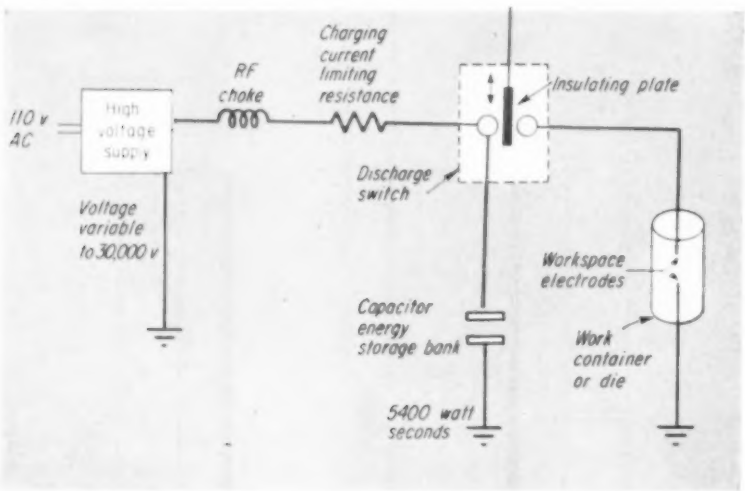
Excellent definition . . .
Sharp bulge was obtained in die shown below. Part was aluminum tube with 0.035 in. wall thickness, 1¼ in. dia by 2 in. long. Bead had ⅛ in. radius



Half a die only . . .
Tube bulging was selected as the best method of evaluating the process, because of convenience in measuring the amount of work done. Lines scribed at ⅛ in. intervals reveal stress-strain characteristics by their displacement



Plenty of punch . . .
This experimental machine has an output of 1800 joules in 40 millionths of a second. The energy created is equal to 33,000,000 ft-lb., and can be repeated, like hammer blows, until the desired work shape is achieved. Note experimental beading die at lower left



Electrical elements well known . . .
Electrical discharge machine can be built from commercial items, is connected to 110, 220, or 440-v shop supply. Current feeds to grounded, high-voltage supply or step-up transformer, thence to RF choke, charging-current limiting resistance, first steel ball in discharge switch, and finally to bank of 50,000 v. capacitors assembled in parallel.

At discharge, Plexiglas plate is withdrawn from between steel balls, spark jumps gap, and again across electrodes in die to ground. At 30,000 v a spark will jump 1¼ in.

a 6-in. aluminum tube having a ¼-in. wall thickness.

Predictable Power Output

Because electrical energy is involved, the energy output of the system is easily calculated. One watt-second equals one joule equals 0.74 ft-lb. For a 5400 watt-second machine, the maximum output would be 5400/0.000040 (sec) = 135,000,000 joules = 99,000,000 ft-lb. Lesser, controlled amounts of energy would be obtained by proper setting of the charging controls.

Although a tremendous amount of force is exerted in an interval long enough to do the work, the energy drain of the system is low. The system is normally charged in 30 sec.

Die Materials

Only a female die member is required. It can be a simple iron, steel, Kirksite, or concrete structure similar to those that have been used in true "explosive forming."

Die Design

Shock waves created by the spark fan out at right angles to the electrode. For tube bulging the electrodes were centered—precisely in the beading die, approximately when free-forming a tube. Sharply defined work features or uniform cross-sections will require use of a die.

Sheet forming and drawing jobs will be tackled next. Details of electrode arrangement have not been worked out, but Republic's engineers are confidently appraising several ideas. Obviously, in a draw die, the pair of electrodes or pattern of multiple electrodes must replace the punch and its action. Republic's people have enough data on how metal is moved by electrical-discharge forces, so that they can go ahead with more involved die-design problems.

This much has been revealed. The distance between the electrodes is important, likewise end contour. A rounded end conserves energy.

Control of Process

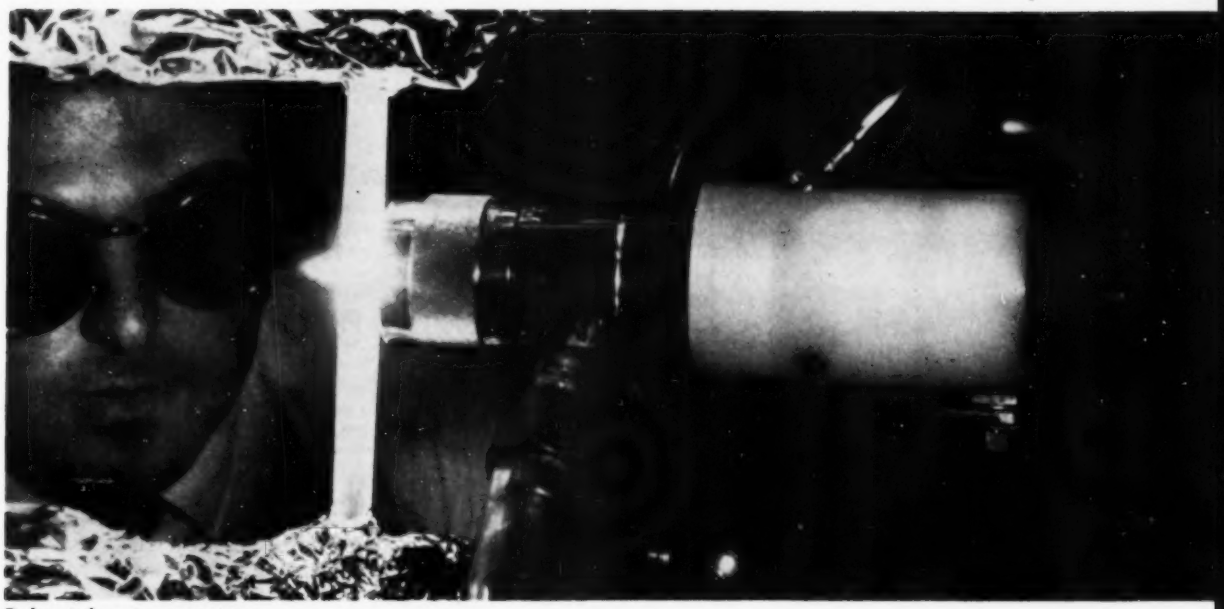
Instrumentation will be simple. With charts showing how much work or metal movement can be obtained, or by trial, it will be possible to duplicate results by setting the controls to a specified charging voltage. "Firing" can be done manually or automatically.

Production Rate

Credence to the belief that this process will not merely be a substitute for ordinary punch press work is given by the electrical characteristics. Charging a bank of capacitors takes about 30 sec. While this is occurring, the part can be loaded. Little idle time will occur. Further, with two banks of capacitors, one can be timed in relation to the other to fire every 15 sec.—for fast-fed parts or to supply successive shots of energy to complete the piece.

Safety

The charging equipment does not need to be close to the operator, and it can be safely inclosed and grounded. Triggering of the circuit can be done through two-hand control. Discharge takes place so fast that the operator cannot get his hands off the controls and into a danger area.



Pulse takes temperature . . .
of plasma jet. Quartz probes in the flame transmit ultrasonic pulses which are converted to temperature measurements. Avco Research and Advanced Development Div has measured its small gun shown here at above 12,000 F. Others hit 30,000 F and up

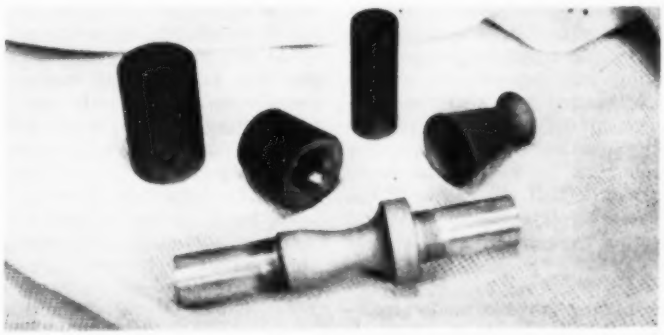
Where is plasma arc today?

About a year ago the plasma-arc torch was heralded as a new production tool with many potential applications in the metalworking industry (*AM*—Nov 3 '58, p87). Supplying temperatures ranging up to 30,000 F and higher, it could vaporize any known substance. Operating at lower temperatures, it could be harnessed for many important jobs.

Where does it stand today?

Has it fulfilled the predictions?

Briefly, it has found a secure, but specialized, place for itself in at least two phases of metalworking—metal cutting and metal spraying—and it shows some possibility of gaining a position as a welding tool. It also has important applications in aerodynamic and thermal testing.



Plasma gun makes complete parts . . .
as well as coatings for parts. In front is a tung-sten-alloy part sprayed on a brass mandrel. Brass will be leached out, as has been done with another part at right, leaving only the sprayed shape

In each of the metalworking areas it appears to have extended the capabilities of the process involved but generally has not obsoleted the existing techniques, at least not so far.

Similar to welding arc

The plasma-arc process is based, of course, on a restricted arc through which a gas is made to flow. In some respects it is very similar to the arc in conventional gas-shielded arc welding. In fact, many plasma torches are powered by welding power supplies—rectifiers or motor-generator sets.

However, a big difference lies in the fact that the nozzle of the plasma torch squeezes the arc into a smaller column than it would normally assume as an open arc. This increases the resistance of the arc column and therefore increases the temperature.

This arrangement also forces the flow of gas to go through the arc instead of merely around it. In doing so, the gas is heated to such a high temperature that it ionizes. Instead of a gas we now have free electrons and positively charged ions—that is, we have a plasma.

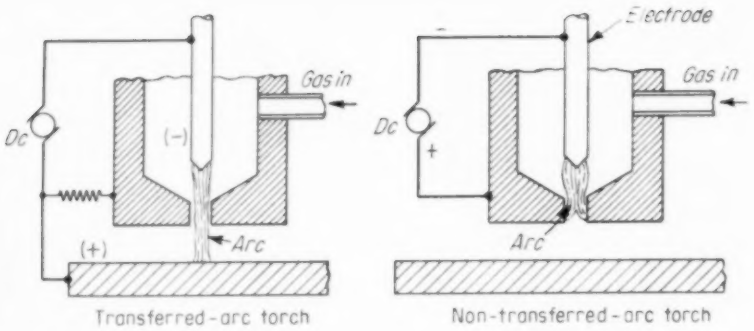
Two kinds of plasma-arc torches are in popular use. Both of them satisfy the basic definition. In one, however, the workpiece is the anode, and the arc extends from the electrode to the work. This is the transferred-arc torch.

In the other, the nozzle of the torch is the anode. Here, the arc does not travel to the work, and the setup is called a non-transferred-arc torch.

Generally, as a source of heat, the plasma torch is said to operate at a lower cost than the oxy-acetylene flame, for equivalent heat-output rates. The main drawbacks are complexity of equipment and high initial cost—$4000 and up.

"If we can develop a torch that will run on alternating current, we'll

Extrusion die lasts longer . . .
with a wear-resistant coating applied by plasma gun. This one is a wire extrusion **die coated with chromium carbide**



Both torches are plasma guns . . .
but they do different jobs. Transferred arc throws heat into workpiece for cutting, possibly welding. Non-transferred arc lets workpiece stay relatively cool, if desired

be able to offer the equipment at a lower price," says James A Browning, director of Thermal Dynamics Corp. He also mentions the hope of operating with compressed air instead of bottled gas. However, both of these possibilities will require considerable development work. For example, one of the big obstacles at present is that the nozzle of the torch is severely eroded by any gas containing oxygen.

Metal spraying

The plasma gun has made significant contributions to the field of metal spraying. Because of its high temperatures and velocities, it can melt and spray almost any inorganic material. The most important of these have been the refractory materials for high-temperature applications. A typical example is coatings on parts for rocket and missile engines.

When the spraying is done with a non-transferred-arc torch, the workpiece can be kept relatively cool. Therefore, the part being coated can be of almost any material, even those with low melting points.

"There are generally four reasons why an engineer may be interested in using a spray-coating process," says Ben Lohrie, president of Plasmakote, an affiliate of Giannini Plasmadyne. "He may want to set up a corrosion barrier, a heat barrier, an erosion barrier, or produce self-supporting shapes. Some of the materials that are sprayed fall into all four classifications, and many of the oxides (molybdenum, for instance) into the first three."

When speaking of corrosion barriers, he points out that, "By nature, a sprayed coating is porous. We like to talk about getting 96% density, but this is not always the case. We have worked out some tricks, such as the use of low-melting-point silver solders to wet the metal, and the use of mechanical burnishing.

"At this stage of development, being able to do a job successfully sometimes hinges more on such tricks than on the application of scientific theory. For instance, we have learned how to apply carbide coatings to the inside of tubing down to $\frac{1}{8}$ in. This can be done for any length of tubing, but you need rifle-boring equipment to do it.

"We have hard-faced aircraft components, gear teeth, solenoid seats, ratchets, pistons, and cylinders. . . . We believe that alumina will be ideal for lining the insides of auto exhausts."

Browning of Thermal Dynamics stated in a paper prepared for the AWS Fall Meeting, **"Plasma is competitive with the more conventional flame over the entire range of metallizing and spraying."** He also said, "In addition to spraying materials which cannot be sprayed with conventional flames, the normally sprayed materials such as alumina and other refractory oxides are more successfully sprayed by the plasma flame than by prior techniques."

Linde Company, Division of Union Carbide Corp, doesn't go quite this far in advancing the cause of its Plasmarc Plating service. Instead, the company says that the plasma torch has *supplemented* its Flame Plating process, a coating technique that employs the energy of oxy-acetylene detonations.

Flame Plated coatings of tungsten carbide, chromium carbide, and aluminum oxide actually have higher density and much greater bond strength than similar coatings applied by the plasma torch.

However, the plasma torch using an inert gas has a marked advantage in applications where the metallurgical integrity of the coating material must be maintained and in making coatings of materials having extremely high melting points, according to H V Mosby, sales manager of the Flame Plating Dept.

Metal cutting

The plasma-arc torch has been in operation as a cutting tool since 1955 when Linde Co introduced its Heliarc cutting torch. Since that time the torch has proved its value in cutting stainless steel and nonferrous metals.

With a gas mixture of 65% argon and 35% hydrogen, the torch is capable of cutting 3-in.-thick aluminum plate at 20 ipm or 2-in.-thick stainless at 15 ipm. These thicknesses are maximum for the torch, but well over 90% of the cutting in aluminum and stainless is within these limits.

The Heliarc cutting torch does not attempt to compete with the oxy-acetylene torch for cutting mild steel plate. Plasma can cut thin plate faster, but oxy-acetylene is the simpler method, and it can handle almost any thickness of steel.

However, the Heliarc cutting torch operates at 28,000 F with a transferred arc and therefore can cut stainless steel without the addition of iron powder required by the oxy-acetylene torch. Other advantages claimed are minimum carbide precipitation, unchanged machinability

and magnetic permeability, and absence of distortion and discoloration.

Can it weld?

Everyone is agreed that the plasma-arc torch is a potential welding tool. But at the same time, everyone speaks of it as a development we can expect sometime in the *future*.

"One of the reasons," says Robert M Gage, assistant manager of electric welding development at Linde Co, "is that the plasma torch is such a close cousin to the conventional Tig process (tungsten-arc, inert-gas) that there is little real advantage to plasma for everyday applications.

"True, the plasma arc generates higher temperatures than the open arc, but the temperature of the arc has never been a limiting factor in welding. Conventional arc temperatures are high enough to weld any known materials. Moreover, the higher temperatures will not cause faster welding speeds unless more heat is actually put into the workpiece."

However, Gage does say that Linde Co has been investigating plasma-arc welding. He also says, "I am confident the plasma arc will find some specialized welding applications—probably some important ones.

"Plasma's future in welding may be based on one or both of two special characteristics:

Stability: as the non-transferred arc is completely enclosed in the torch, it is not subject to magnetic influences that cause arc blow and erratic operation.

Colimation of energy: the plasma, or flame, comes out of the orifice in a virtually straight line. Therefore, it can be controlled much more precisely than can the conventional welding arc."

Browning of Thermal Dynamics agrees on the factor of stability but adds, ". . . good use can be made of the transferred arc for fusion welding where heat-transfer rates reasonably greater than those obtainable by open-arc means are desired."

Ben Lohrie, speaking for Plasmakote, says, "One of the things we did recently was to weld tungsten, and at that moment, I decided that this was an area worth spending some money on."

Undoubtedly, other organizations are also spending money, and it should not be too long before we hear that the plasma arc is starting to find its place in the field of welding.

SAE fights welded vs honeycomb battle at Aeronautic meeting

Ground-support equipment for missiles and rockets is rivaling in interest the more exotic problems of missile manufacture and the battle between welded and brazed honeycomb structures. Sessions on all these subjects were packed during the National Aeronautic Meeting held by the Society of Automotive Engineers in Los Angeles October 5 to 9.

Solid-fuel missiles eliminate field fueling problems with the equipment this requires, but weight becomes a major factor. Fuel may be half to two-thirds the weight of the missiles and the largest components already weigh as much as 50 tons.

Rocket motors are both heavy and fragile and must be protected from shock that could split the propellant away from the case or distortion that could throw the missile off course.

Welded vs brazed

Relative merits of welded and brazed honeycomb structures were argued. Costs of contoured brazed honeycomb range from $200 to $1100 per sq ft at current production levels. Brazed honeycomb is running about twice the price of welded structures but in production quantities it might run three to five times the cost of conventional structure in such quantities, according to one authority. Much push has been given the brazed structure by the decision of North American to use it in the B-70 bomber.

Extrusion plans

New extruding techniques, using glass lubricant, are being developed by Norair Division of Northrop in both high-temperature steel and beryllium. Lyle Christensen of Northrop said that Allegheny Ludlum seemed to be closest to a solution to the problem of extruding H11 tool steel and A-286.

Best results have been obtained by keeping the billet inside a radiation shield to help hold it at 2300 F. Glass lubricant is injected around the billet while it is in this shield and the container liner on the extrusion press is heated to 900 F to reduce heat losses.

A-286 billets have been capped with carbon steel to reduce starting pressure. The high-strength A-286 follows better once flow has been established by this leader.

Just before the steel strike interrupted the tests, nickel plating of the billets was being tried with promising results.

In the work so far on beryllium, best results have been obtained with cobalt-chromium dies and glass lubricant. Billets were heated in salt baths and in argon atmospheres. Optimum extrusion temperature seems to be between 1750 and 1850 F. Previous attempts to extrude beryllium have been after canning and this represents an effort to extrude it bare. The work so far proves that it is feasible and the forecast was made that structural extrusions in beryllium will be available in two years.

Shear forming

Pratt & Whitney Aircraft has now produced more than 22,000 parts by shear forming (roll flowing). In tooling for this operation, mandrels are now usually made from D2 steel and rolls are made from M4 or D7 steel.

Larger mandrels are made hollow with supporting rings inserted when additional strength is required. Major tooling problems seem to be in heat treating the tooling in the larger sizes. Tendency seems to be toward higher surface speeds in shear forming, with Marquardt now running parts in N155 at 1600 sfpm.

Producing large vessels

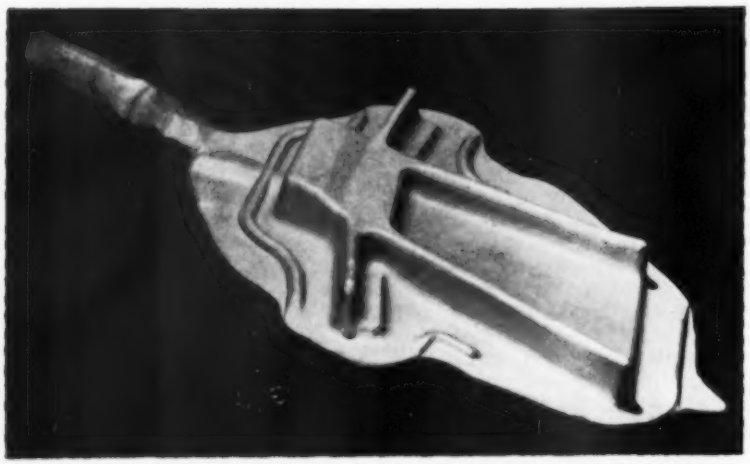
Various approaches to the manufacture of large rocket cases and pressure vessels were discussed heatedly. Many of these are made by rolling and welding, but there is considerable use of structural plastics and shear forming. Curtiss-Wright is making missile cases by the technique originally developed for propeller blades (extrusion plus nitrogen pressure-bulging into a die).

More explosive forming

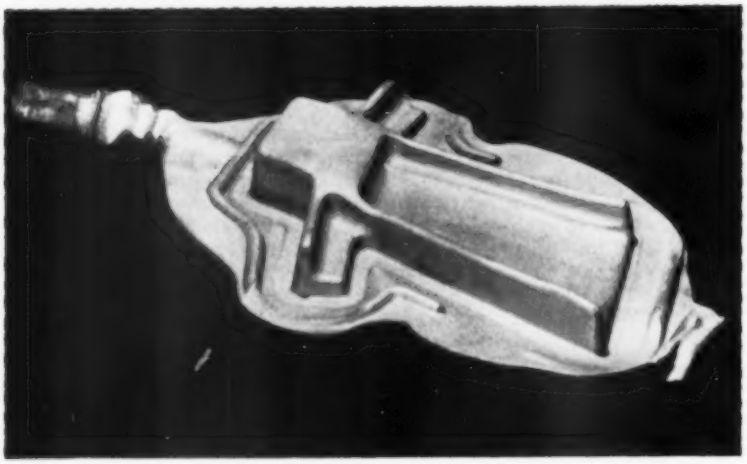
For final sizing, there is growing use of explosive forming techniques. Air must be evacuated from the space between work and die, even if the final sizing involves only a few thousandths movement, or a compressed air bubble will form that will rupture the case.

One problem reported in heat treating the tanks: Shear-formed work contains stress points that cause problems with holding size during the heat treat. Current work with hot shear forming will eliminate this problem.

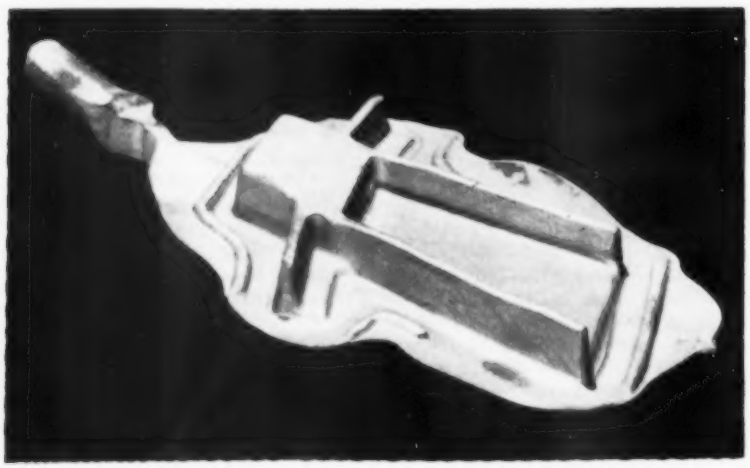
Heated dies produce



Blocked aircraft forging prior to final press forging in heated dies



Metal flow achieved with dies heated to 300 F; pressure 1200 tons



Greater metal flow is obtained with dies heated to 1600 F

Precision-cast Inconel 713 C dies, heated to 1600 F, attain precision of form and increased depth of flanges, permit reduced draft angles. Dies cost one-third less than machined die blocks

By Paul R Gouwens, supervisor
Foundry and Steelmaking Research,
Armour Research Foundation, Chicago

Materials and techniques have been developed for forging ferrous metals with precision-cast, heated dies functioning at 1600 F.

The development permits forging to closer precision and to thinner metal sections with fewer die sequences than the conventional forging process. This is made possible by virtue of the much reduced rate of heat extraction from the forging by the heated dies. Consequently, the forging maintains workable plasticity longer, thus enabling the metal to flow further into intricate or thin-section die cavities.

As proof of the process advantages, more than 250 aircraft forgings of AISI 4340 steel, with a projected area of 30 sq in., were made in the experimental dies. The dies, cast from Inconel 713C, were subjected to a total load of 1200 tons while at 1600 F during the forging cycle. It was conclusively demonstrated that metal flows more readily under such conditions. Depth of flanges on the forged part increased 81% beyond that attained with the same die operating in the 300 to 800 F range. No deformation, erosion, cracking, or heat checking of the heated dies was encountered.

During the course of the research the following problems were solved:

1. A method for casting dies, capable of producing precision dimensions, excellent surfaces, fine grained structure and internal soundness.
2. A practical means of heating the die block and maintaining it at temperature.
3. Alloys capable of resisting forging die loads while at 1600 F.
4. Creation of a lubricant and parting agent operative at these high temperatures and forging pressures.
5. Proved advantages and production limits of the cast die and the

better forgings

heated die on a laboratory test piece and on an actual military aircraft forging.

As a result of this work, casting methods can be applied to the production of highly alloyed press forging dies. This permits easy replication of complex shapes in a die material which cannot be readily machined by the usual machining process. The technique developed also should be applicable to the more conventional forging die steels, and should prove functional for cast dies to be used on drop hammers.

It is expected that the lead time required for die procurement and the total die cost will be reduced when the process is applied to complex die configurations. An estimate of the cost of cast dies indicates a savings of one-third of the total cost of a fully machined die block.

The heated die is applicable where the attainment of greater precision in the form of reduced metal sections, reduced draft angles, and increased depth of flanges is mandatory. Use of heated dies is of particular importance for aircraft forgings where minimum dimensions are required for weight reduction.

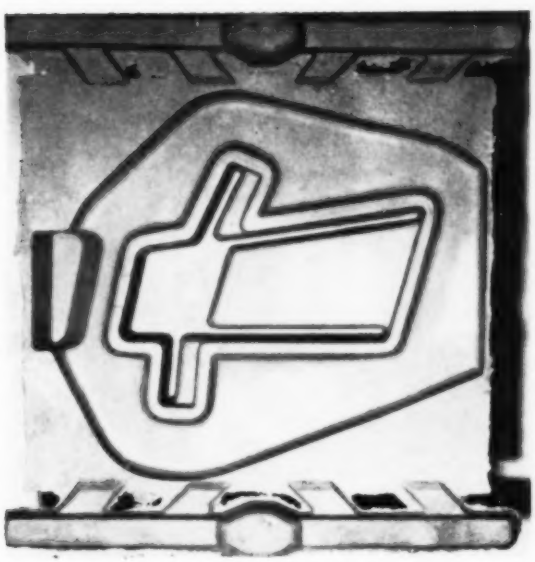
When used for forging metals which have narrow forgeability ranges, because of hot shortness and high hot strength, the heated die has obvious advantages. The exotic heat-resistant alloys of the nickel- and cobalt-base types and titanium are representative of this problem. Future application also probably includes shaping of the refractory metals such as columbium, tantalum, molybdenum, and tungsten, although this would require extension of the present work to higher temperature limits. Only by such means can the refractory metals be truly hot-worked to small-sized parts.

The foundry technique has as its most important aspect a molding material consisting of a powdered graphite bonded by bentonite clay. Mold sections made from this mixture have a high thermal capacity, which favors rapid solidification of the molten metal. The grain size resulting from casting against this graphite, which is at room temperature, is finer than usually attained. Internal soundness is optimized by the pronounced thermal gradients in the casting.

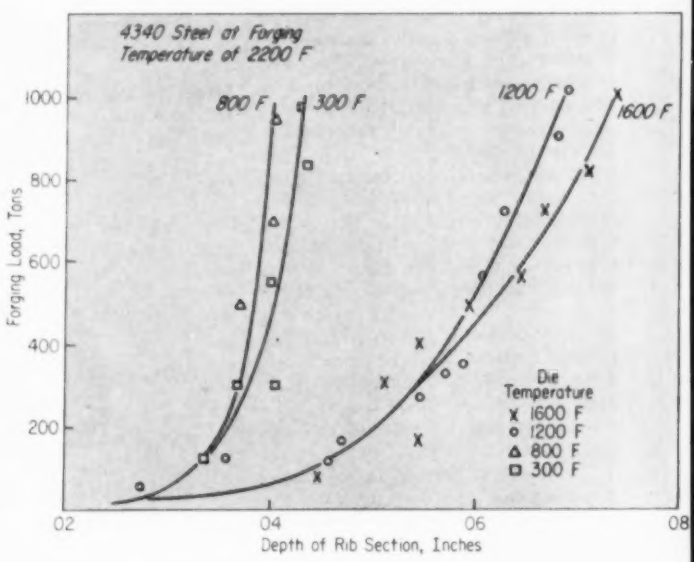
Prefiring of the molds to 2000 F reduces adsorbed gas content, thus preventing gas porosity in the die. Reaction between the mold and the metal will occur to cause extremely rough surfaces unless a moderately impermeable mold wash of aluminum silicate and silica flour is utilized. Surface finishes of 125 to 150 rms were eventually achieved when this mold wash was used. As a result, no machining, grinding or polishing had to be done in the die impression. The dimensional stability of the mold and the predictability of die shrinkage permitted maintaining the tolerance within 0.020 in. over an 8-in. dimension.

Power Consumption

Resistance heating units of the Calrod type are employed for heating the die in the experimental setup. The die block consists of an assembly of four separate layers stacked on one another and keyed together by stainless steel wedges. Calrod heaters, stacked four high in several vertical slots in the die supporting block, and identical stacks on two opposite sides of the die, furnish 20 kilowatts on a 50%-duty cycle. Block insulation is assembled



Die blocks . . .
are Inconel 713C castings. Lower die block is shown in as-cast condition. Casting method avoids need for finishing the die cavity



Influence of forging tonnage . . .
and die temperature on die filling ability on aircraft part. No explanation was found for better results at 300 F than at 800 F

on the four sides and a water-cooled base block protects the press from conducted and radiated heat.

In high-temperature forging dies we must have oxidation resistance, compressive deformation strength at elevated temperature, hot-strength stability on aging, and hot-wear resistance. A nickel-base alloy, Inconel 713C and a cobalt-base alloy, HE 1049, are our first and second choices on the basis of all-around excellent performance.

The requirements of the die material cannot be specified exactly. To forge alloys with good hot strength, such as AISI 310, the compressive yield strength at 1600 F must exceed 25,000 psi. Oxidation resistance at 2100 F is another requirement, because die surfaces in contact with forgings may reach this temperature. Furthermore, metallurgical changes, such as aging, must not result in marked property or dimensional changes. Inconel 713C exhibits a compressive yield strength as high as 35,400 psi at 1800 F.

New Die Lubricant

Conventional forging lubricants are not satisfactory because they will not remain in place on the hot dies. We tried various alternatives such as silicons, molybdenum disulfide, molybdenum oxide, liquid metals, etc, but these were unsuccessful. As a result of this study a new high-temperature lubricant consisting of powdered potassium iodide (67%) and flake graphite (33%) was developed. This mixture is applied as a powder which liquifies as soon as it strikes the die surface. The salt acts as a vehicle for the graphite. The parting and lubrication at temperature are entirely satisfactory. Moreover the mixture does not build up excessively, because of the high vapor pressure of the salt, and it is relatively non-corrosive to hot dies. The use of a good lubricant increases die filling equivalent to that obtained by operating the die 300 F hotter.

Composition of Inconel 713C is: C—0.020 max; Mn—1.0 max; S—0.015 max; Si—1.0 max; Cr—11.0-14.0; Mo—3.5-5.5; Ti—0.25-1.25; Al—5.5-6.5; Fe—5.0 max; Cb + Ta—1.0-3.0; and Ni—balance.

The research leading to the above developments was sponsored by the Manufacturing Methods Division, AMC Aeronautical Systems Center, U S Air Force, Wright-Patterson Air Force Base, Ohio, under contracts 35914.
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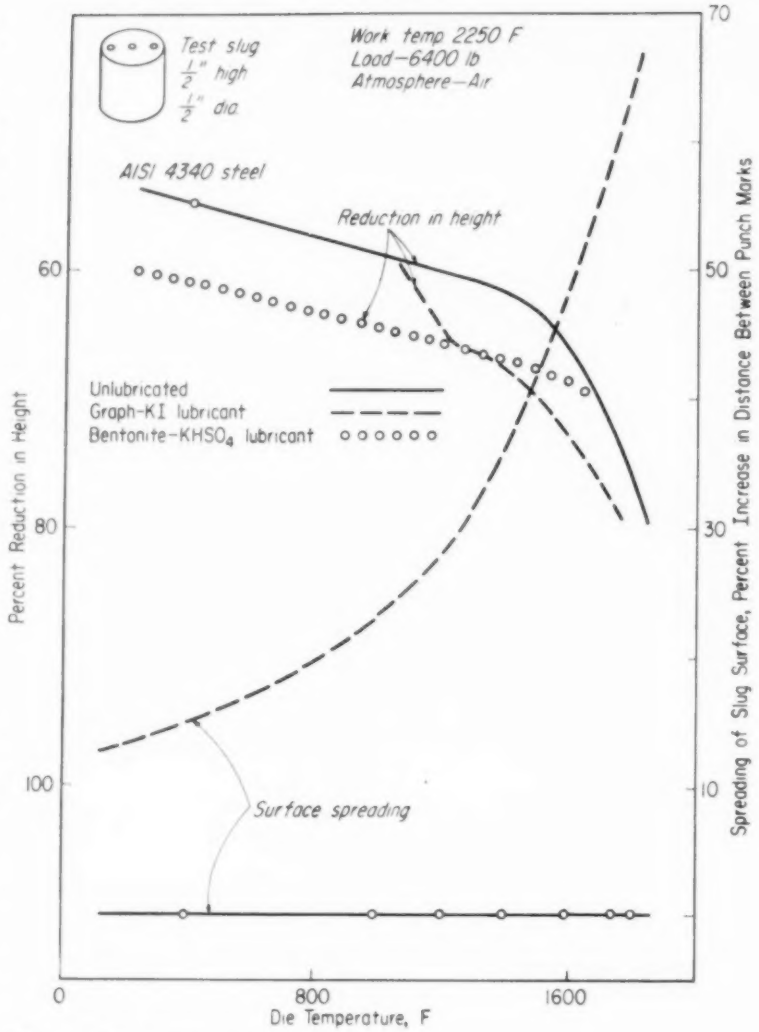
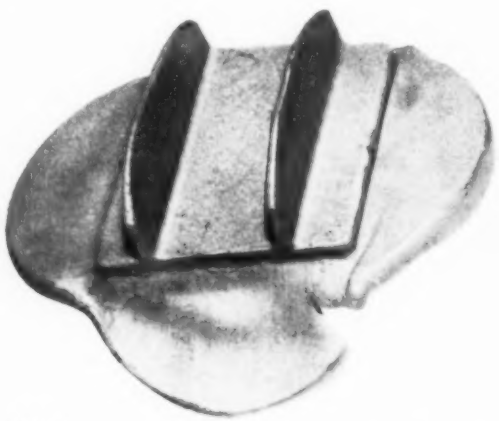
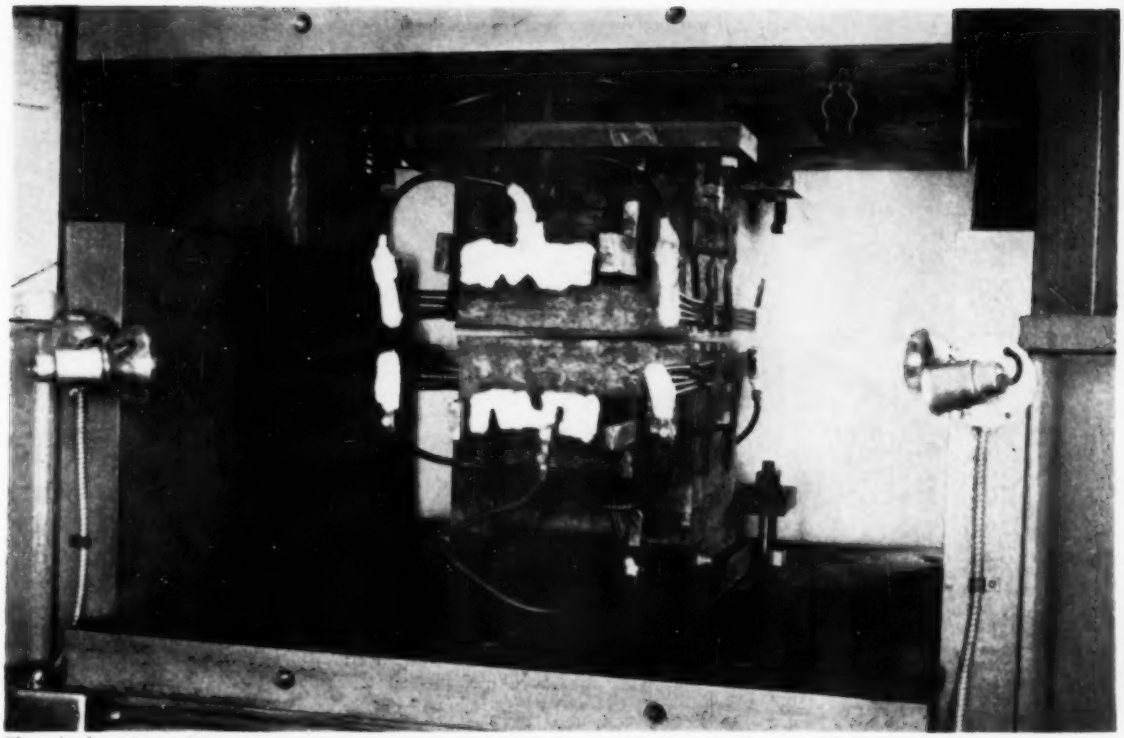


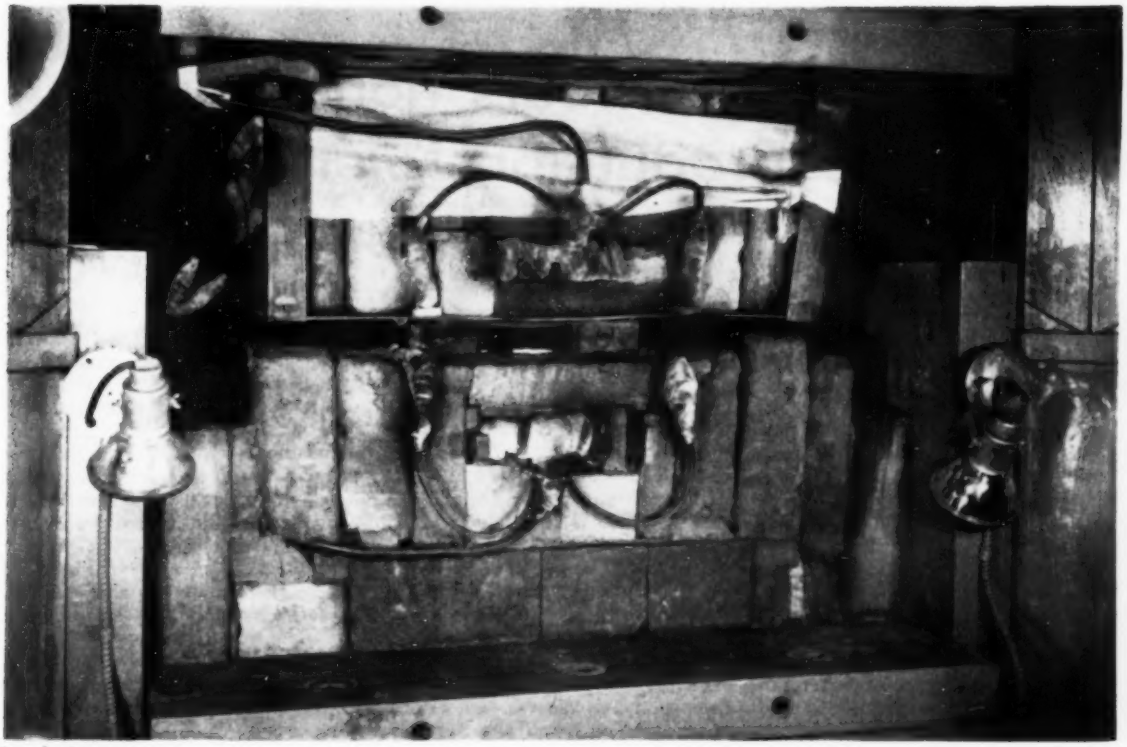
Effect of die temperature . . .
and lubricants on surface movement and reduction. Specimen: Test slug of AISI 4340; ½ in. high by ½ in. dia



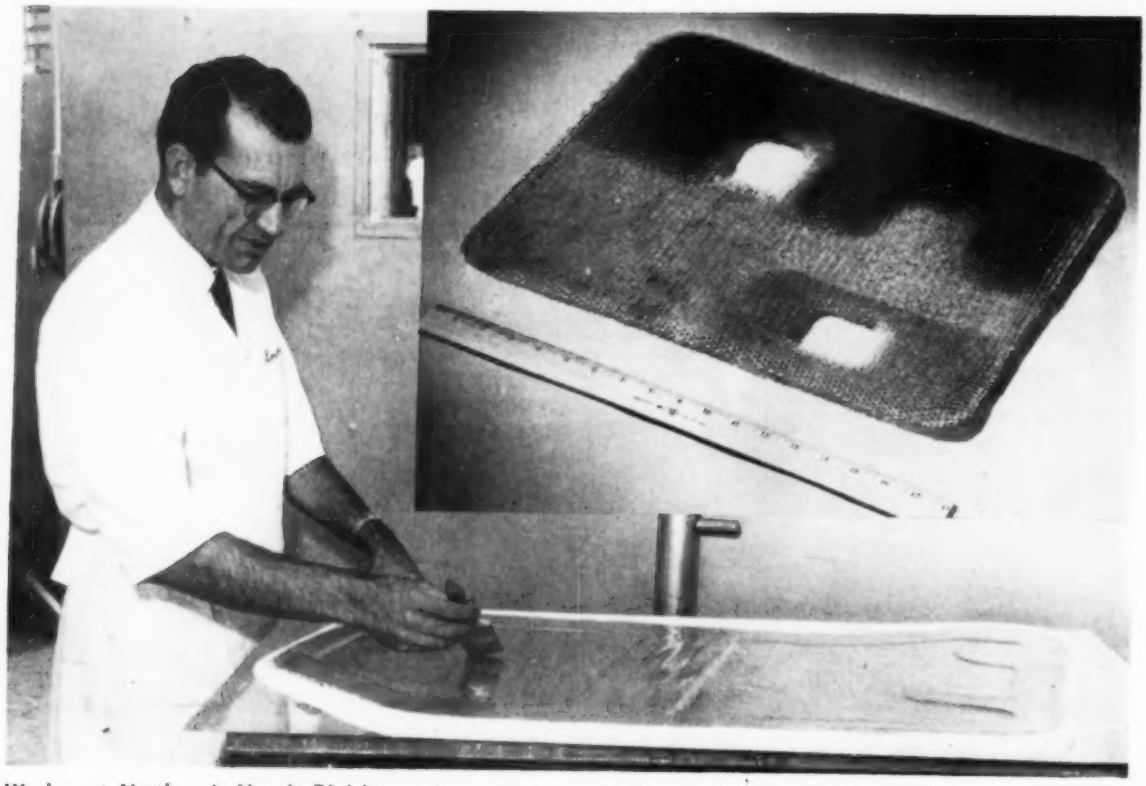
Ribs 1½ in. high . . .
were forged in one operation, starting with ½ x 4 x 4 in. slug. Material: AISI 4340; die temperature, 1400 F; applied load, 600 tons



Electric heating elements . . .
were used adjacent to the upper and lower die blocks. Insulating blocks and water cooling are not shown



Insulation . . .
and water cooling completed the setup for heated die assemblies



Worker at Northrop's Norair Division applies maskant to a plaster negative, which will subsequently be chemically etched to produce contoured honeycomb (inset) to extremely fine tolerances

Chem-milling contours honeycomb to ±0.005 production tolerances

Contoured honeycomb, one of the most expensive aircraft materials, is now being produced by chemical milling at a savings anywhere from 40% to 75% over conventional production methods. Jointly unveiled this week by Turco Products Inc and Northrop Corp's Norair Division, the new process chemically removes unwanted material to produce honeycomb structures of complex contours. Rejects are virtually eliminated, Norair claims.

Achieves fine tolerances

The process can produce contoured steel or aluminum honeycomb to production tolerances of ±0.005, and with special handling aluminum can be held to ±0.003 and steel to ±0.002 in. A complete line of materials for the process has been developed, and specifications will be released by Turco at the forthcoming Metals Show in Chicago.

Process works this way:

First, a pattern is made to the exact configuration desired for the honeycomb. Metal or tooling resins can be used.

Then a negative is cast from the master pattern, using a water-mixed, plaster-like frangible material which is oven cured.

The negative is next sprayed, brushed or flow-coated with a vinyl maskant to a depth of 10 to 125 mils. (Thickness varies with the job, isn't really critical). Negative is then cured.

Honeycomb core is pressed through the mask and into the negative, and the honeycomb is reinforced by filling the cavity with a hot-melt core seal.

Negative is removed by a water-pressure rinse, and the exposed area is removed by chemical milling. Because the etchant attacks the core from all sides, removal takes only 5 to 10 minutes in a bath at 120 F to 160 F. Finally, the maskant and core-seal are stripped from the finished honeycomb.

Cuts costs 'way down

Norair reports comparative costs for machining a 16-in.-wide, 36-in.-long, $\frac{3}{4}$-in-original-thickness core for a T-38 landing gear strut door (thickness of final part varies from 30 to 67 mils, with some areas feathered down to 0.0 mills) as $800 for chemical milling versus $3500 for "machine and crush." In job lots, such parts could be produced by chemical milling with an even sharper cost-per-piece contrast with conventional methods.

Turco, which plans to license the process to interested companies soon, believes this well may be the breakthrough that will introduce widespread use of honeycomb in non-aviation industries.

Tool engineers talk plastics, numerical control, explosive forming

"If you are not making some of your tools with plastic, you are missing the boat," said Alan M Fullarton of Convair Astronautics, Division of General Dynamics Corp, at the semi-annual meeting of the American Society of Tool Engineers in St Louis.

He also stated that the aircraft and missile industries employ a higher percentage of plastic tools than most industries. In his round-up of typical applications in the aircraft & missile industries, he cited a number of advantages of plastic tools compared with hard tools:

- less expensive
- can be made more quickly
- easier to make complex shapes
- can be altered more easily
- are lighter, easier to use
- will not scratch aluminum

Plastics in planemaking

Aircraft and missile makers are putting plastics to work in gages, templets, casting patterns, forming molds, facings for drop hammers and stretch forms, spinning chucks, tracing patterns, etc.

Fullarton attributes the increased use of high-temperature plastic tools to "improved fabrication techniques and tool designs gained from past experience . . . We had many failures a couple of years ago, but by following the directions of the manufacturers of a good high-temperature formulated epoxy as to mixing, applying, oven curing, and designing a tool correctly, we are now having good results."

Plastic electrodes

Another application for plastics—electrodes for electrical discharge machining — was mentioned by George G Bott, process engineer at Grumman Aircraft Engineering Corp. Both wooden and plastic shapes have been plated by the electroless nickel plating process and then coated with brass or copper by spraying or plating to make electrodes of a desired shape.

One important factor in EDM, they said, is a "distinct relationship between atomic bonding strength and the amount of metal removed." That is, the elements with low compressibility factors also showed low metal-removal rates. "This material characteristic could be an aid in predicting machining difficulty and time."

Numerical control

"The potential of numerical control has been only partly realized because its role has been relegated to the manufacturing phase," according to William B Johnson, industrial engineer at Rocketdyne Division of North American Aviation, Inc. "It is the author's strong belief that the greatest growth of numerical control as a tool will occur only when we start from the design intent and go on to utilize this tool through all our manufacturing, tooling, and inspection."

Grinding with abrasive belts

Because of recent design advances in abrasive belts and the contact wheels over which they run, coated abrasive belts now provide a practical and economical method for precision grinding of rolls to close tolerances and fine finishes. In his discussion of belt grinding, Warren K Seward, supervising engineer in Carborundum's Coated Abrasives Division, said that while abrasive cost for belt grinding may equal or exceed that for the grinding wheel method, definite savings are made through reduced labor and overhead costs.

Reduced testing time

Assembly and testing of a product should be thought of as an integrated operation, said Arthur E Moxley of IBM's Test Equipment Engineering group, in his paper on the relationship of special electronic test equipment to mechanical tooling. It has been IBM's experience that improved subassembly testing has reduced total test time. For one computer unit test time was cut from 20 to 10 hours.

Explosive forming

High-energy-rate forming with explosives is one of the most promising fabrication techniques for forming aircraft and missile parts from the high-strength, difficult-to-form materials, reports Arthur Wickesser, Jr, manufacturing engineer, Grumman Aircraft Engineering Corp. After a thorough study of the subject, Grumman is now forming some of their aircraft production parts in this way. Other applications under study include explosive cold welding, metal compacting, blanking and shearing, dimpling, and hot explosive forming. The latter may well prove to be one of the most useful application of this new technique.

Machining aluminum and Zircaloy

Francis X Bolt, engineering designer, and Bernard Polonsky, mechanical engineer, at Watertown Arsenal reported on cutting tools developed for machining 6061 (61S) aluminum in its forged condition (Brinell 49). In general, they offered these precautions: "The machine tool should be as rigid as possible and capable of operating in the high-speed range. Cutting tools should be carefully ground and have a high finish. Honing is highly desirable. In instances where the machine-tool speeds are limited, high rake angles are necessary."

"Zircaloy-2 can be machined with tools generally recommended for machining high-strength aluminum alloys, "according to Alfred O Schmidt, chief engineer, and J R Roubik, research engineer, of Kearney & Trecker Corp. These tools have positive rake angles and high relief angles.

Among the best ways to prevent Zircaloy fires in the shop are: "sharp, unhoned tools, elimination of chips, avoidance of very fine chips in the cut, and resharpening of tools after a very small amount of wear is noticeable."

Several accelerated tool-life tests were investigated at Watertown Arsenal by Roy F Mennell, assistant branch chief, and Edwin A Jeffry, mechanical engineer, Experimental Machining Branch. Each test, they said, "showed limitations, and none is satisfactory for general evaluation of machining variables. Therefore, tool-life tests should be made by running tools to complete failure . . ." except where accelerated tests can be justified by specific evidence.

Three-ring circus of new ideas

Fanfare, festival and carnival spirit have just marked the biggest mass introduction of new concepts and new models in the history of the machine tool industry. The occasion: giant Cincinnati Milling Machine Co's 75th anniversary.

About 250 of operating men from metalworking plants all over the country were on hand October 5 as the Mill took the wraps off more than a score of new machine tools, many of them entirely new in concept, in an all-out effort to "break the cost barrier" on machine tools.

The circus-like atmosphere, climaxed by a mock political convention to nominate the Machine Tool of the Year, cloaked the serious purpose of Cincinnati's open house—87 individual demonstrations of machine tools in operation. There were on display, for example:

- A more-than-200-ft-long Intraform machine for fabricating ferrous and nonferrous precision tubing.
- Seven machine tools, all different, operated by Cincinnati's Acramatic numerical-control system.
- Cincinnati's newly introduced line of 33 Elektrojet electrical discharge machines.
- A metalforming machine that squeezes metal instead of cutting it.
- An automatic machine for sharpening cutting tools.
- A super-precise grinder that grinds mating parts to fit within millionths of an inch.
- A fixed-knee milling machine that combines advantages of three types of millers.
- A numerically controlled lathe.
- . . . and a new lathe that sells for $512 less than the same make did in 1950!

The latter lathe (actually a complete new line) is said to be the first geared-head lathe with power dial speed shift in the low-price ($4575) range.

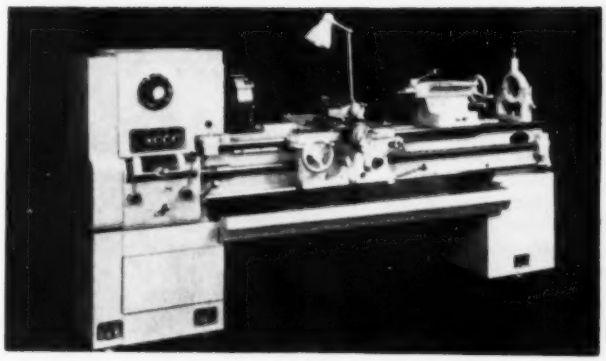
To change spindle speeds on this Hydrashift lathe, the operator merely dials the desired rpm, and shifting is done automatically by hydraulic power. Other innovations: high-speed range to 3000 rpm, a cross slide for heavy, high-speed cuts.

New fixed-knee milling machine has a design unique in that it eliminates the knee and transfers vertical motion to the spindle carrier. This general-purpose machine is claimed by Cincinnati to combine the rigidity of a bed lathe, the convenience of a knee-and-column mill, and the capacity of a rise-and-fall type. Machine has 32 feeds and 24 speeds. Available in four models ranging from 20 to 30 hp, with 72 to 80-in. table travel, 12-in. saddle travel, and 20-in. vertical travel.

A new centerless grinder, the 210-6—part of Cincinnati's completely new Centuramic line—handles up to 3-in. OD work with a standard 6-in.-wide wheel, can also handle counterbored wheels up to 8 in. wide. Other Centuramic grinders: a 20-hp model with 8-in. wheel width, a 25 hp model with 12-in. wheel width, a 30-hp model with 15-in. wheel width, and a 40-hp machine with 20-in. wheel.

Shown, too, at Cincinnati's open house was the complete line of recently introduced Elektrojet building block electrical discharge machines—33 in all. Designed for die-sinking, for machining "impossible" materials, for cutting holes and odd-shaped pockets, and for tough machining jobs involving burrs, brittleness, warpage, etc, these machines are completely automatic.

A new automatic cutter grinder is designed to team up with a milling machine, and to allow an operator to sharpen his own cutters while his



CIRCUS ATMOSPHERE marked The Mill's 75th anniversary as visitors rode to and from exhibits on a miniature train (above), saw a mock political convention in a Cimasphere bubble tent (left). But underneath all the fanfare was solid news for metalworking—introduction of new concepts and more than a score of new machine tools such as the Hydrashift lathe (right). Despite all its improvements, the new lathe actually costs $512 less than its 1950 counterpart—The Mill's way of "breaking the machine tool cost barrier"

marks "The Mill's" 75th year

mill is in operation. Machine, which grinds right- or left-hand plain or stagger-tooth cutters, maintains consistency from cutter to cutter.

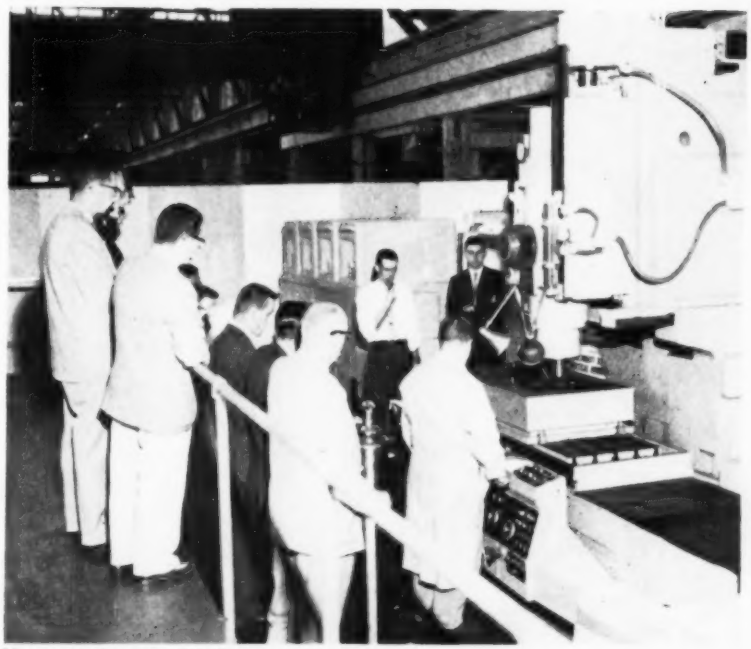
At the open house, Cincinnati presented its new 100 and 200 Series Hypowermatic bed-type milling machines. Rise-and-fall and tracer-controlled Hypowermatics are equipped with Cincinnati's "peg board" Telematic controls, which allow complete, complex milling operations to be programmed quickly.

Accent on N/C

Perhaps the most outstanding trend noticeable at the open house was the concentration which Cincinnati and its affiliate companies, Heald and Cincinnati Lathe & Tool, placed upon getting numerically controlled machine tools into the scope of the small-to-medium shop.

On display in Cincinnati's Numerical Control Center were a half-dozen-or-so machine tools illustrating Cincinnati's concept of "unified control" (simplification of numerical control to get its cost down):

- A 30 x 52-in. vertical Hydrotel, doing vertical diesinking on a milling machine cover die.
- A 16 x 30-in. vertical Hydrotel



Numerical control takes a step forward . . .
The direction: lower prices. This is a numerically controlled 30 x 52-in. vertical Hydrotel milling machine, one of two demonstrated in Cincinnati's Numerical Control Center. Cincinnati believes that numerical control will gain widespread acceptance when it becomes less expensive and when the complete system (machine and controls) is integrated under the responsibility of the machine-tool builder

Cincinnati milling . . .

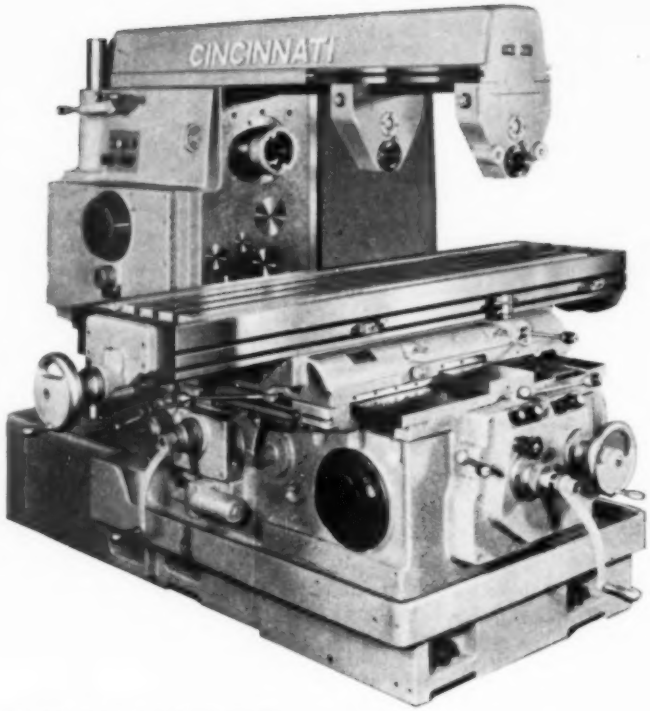
machining 3-D right and left-hand parts with a single program.

- A Heald Model S Borematic precision-machining a free-form part under numerical direction.
- A 24-in. sliding head drill, made by Cincinnati Lathe & Tool, with a low-cost 10 x 10 in. numerically controlled positioning table.
- A 20 x 48-in. two-axis positioning machine with numerical control of position, speed and feed.
- A 48 x 168-in. traveling column Hydrotel contouring an aircraft part by numerical control.

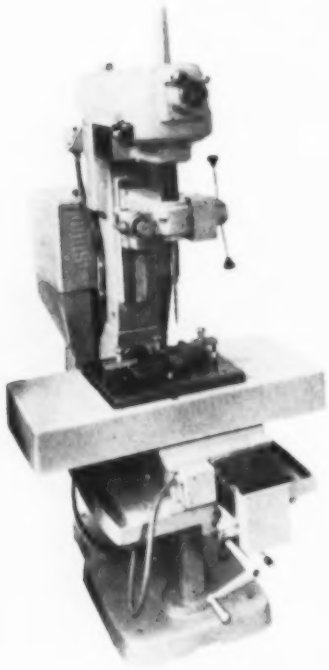
Too, visitors were given a look at numerical control of regular production jobs in plant manufacturing areas and at numerical control of a Cincinnati lathe.

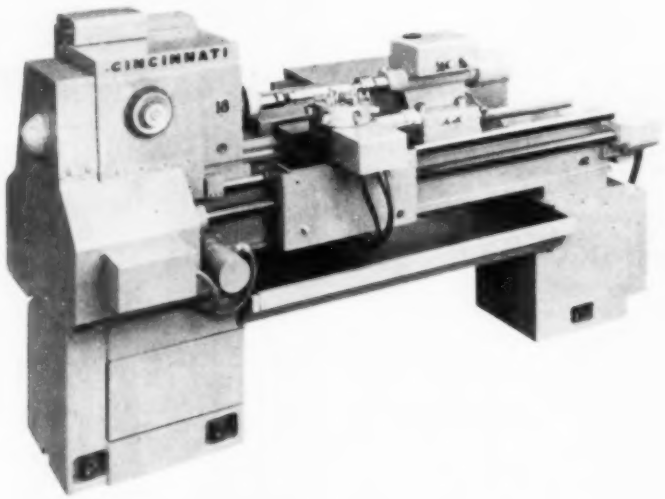
Speaking during the mock political convention, Cincinnati Board Chairman Frederick V Geier put his company's aims in a nutshell: "Progress in machine tools is the very cutting edge of economic progress . . . I am certain that we shall discover yet more effective ways to drive power through mechanisms and tools to produce work more precisely and at lower costs.

"That is both a prediction and a pledge from us of Cincinnati."

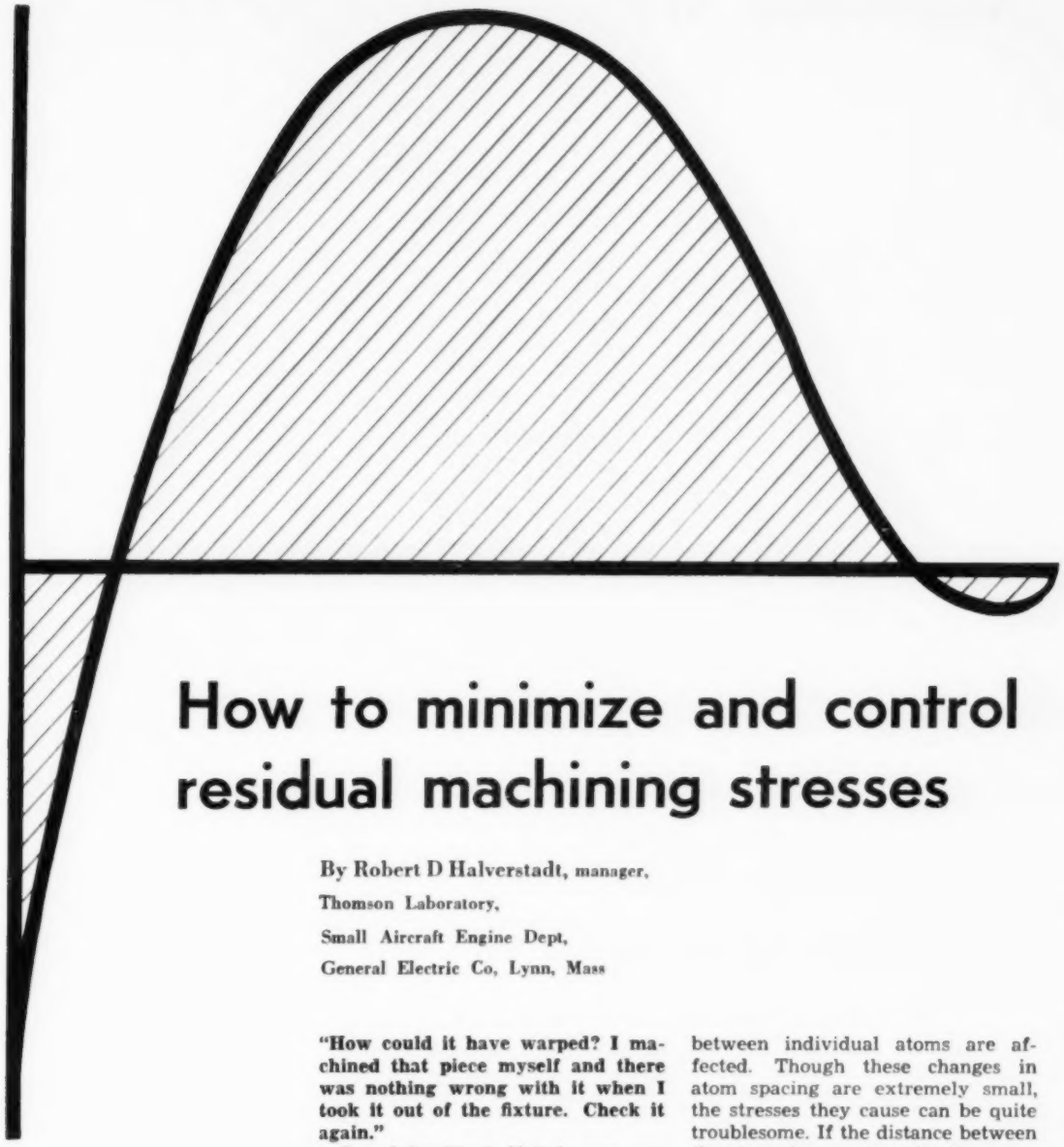


Miller with 3-way advantages . . .
(convenience of knee-and-column type, capacity of rise-and-fall, rigidity of bed-type) handles reciprocating, box milling and climb cuts, has an automatic backlash eliminator. The just-introduced miller comes in four models





Numerically controlled machines . . .
Cincinnati Lathe & Tool introduced two new numerically controlled machines at the Cincinnati open house: a 24-in. sliding head drill (left) with numerically controlled positioning table, and a lathe (above). Cincinnati Acramatic tape control units (on top of the drill, in bottom of the lathe's console) control both. Table of the sliding head drill may also be positioned by controls on the front of the console



How to minimize and control residual machining stresses

By Robert D Halverstadt, manager,
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American Machinist
Special Report No. 481
October 19, 1959

"How could it have warped? I machined that piece myself and there was nothing wrong with it when I took it out of the fixture. Check it again."

Sound familiar? If it is any consolation to you to know that you're not the only one with such a problem, take heart. This is a fairly common problem, though very little is ever done about it until after the damage is done. When a part bends or warps without any apparent cause, it usually does so because of internal stresses set up by plastic deformation in the material. Called residual stresses, these stresses occur when the material is deformed in such a way that the distances between individual atoms are affected. Though these changes in atom spacing are extremely small, the stresses they cause can be quite troublesome. If the distance between the atoms becomes greater than normal, the residual stress is tensile; if the distance becomes less, the stress is compressive.

Can anything be done about these stresses? In some cases they can be eliminated entirely; in others, holding them to a minimum is about the best you can do, and often this is all that is really necessary. To turn out parts with minimum stresses, just use a little common sense and follow the guides presented here. You shouldn't have much trouble.

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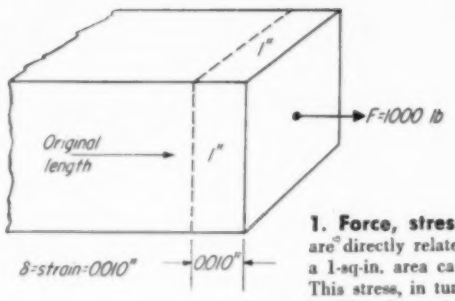
What do we mean by stress and strain?

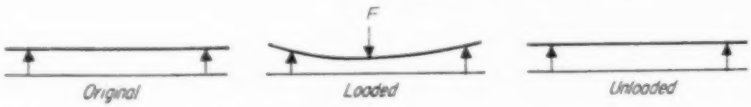
Force, stress, and strain are directly related. Stress means the force per unit area. For example, if you pull on a 1-in.-square bar (Fig. 1) with a force of 1000 lb, the stress would be 1000 lb per sq in., or 1000 psi. Strain is simply the amount of deformation caused by the stress. If the bar should stretch 0.010 in. when you apply the 1000-lb force, we would say that the strain is 0.010 in. Strain, however, is usually stated as unit strain, which is the deformation per unit length. If the bar were 10 in. long, the unit strain would be 0.001 in. per in.

Now in the normal case of an externally applied load, the stress will cause a definite amount of strain, but the strain will return to zero when the load is removed (Fig. 2). This is true until you stress the material beyond its yield point, the point at which it becomes permanently deformed. The same rule applies when you are machining a workpiece. You expect the piece to give slightly under the pressure of the tool, but you expect it to spring back to its original position when the tool has passed over it.

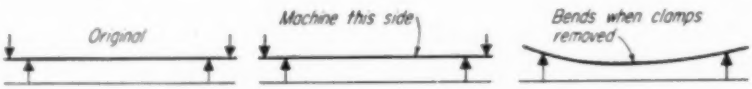
This is not the case, however, when you run up against residual stresses. Residual stresses cause strains or bending without the application of an external load (Fig. 3). How many times have you seen a machined part that stretched out of shape when it was removed from the machine or fixture? This bending is the result of forces confined within the part, and the part cannot return to its original position unless you remove or equalize this force by some balancing force from an external load, or add some new internal force. Since the part is distorted dimensionally after machining, it is often assumed that the machining operation itself has imparted some damaging residual stress. This is not always the case; sometimes the machining has removed some earlier stress, and this brings on the bending.



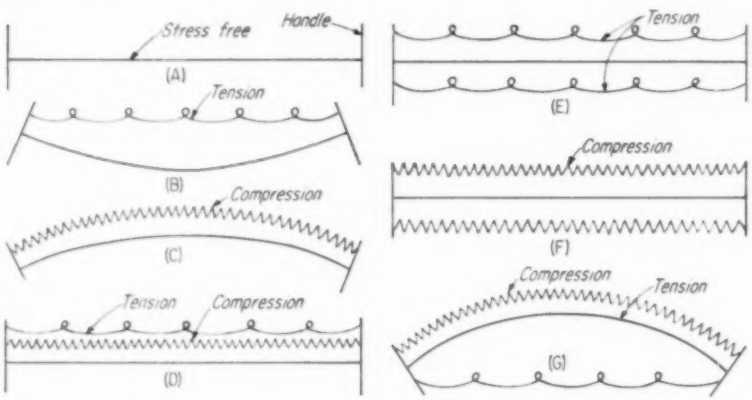
1. Force, stress, and strain . . .
are directly related. A force of 1000 lb acting upon a 1-sq-in. area causes a stress of 1000 lb per sq in. This stress, in turn, causes the bar to elongate 0.010 in. This change in length is called the strain



2. The strain induced in a part . . .
by an external force returns to zero when that force is removed, as shown in this sketch of a simply loaded member. In a like manner, tool pressure causes a part that is being machined to move away from the tool. But the part springs back when the tool passes on



3. Residual stresses cause strain . . .
or bending without the application of an external force. The part will not return to the normal position unless the residual stresses are removed or balanced



4. Mechanical spring analogy . . .
makes residual stress analysis much easier. Each example is explained in the text. Though these are extremely simple cases, this analogy holds good for even the most complex stress combinations

The spring analogy

Residual stresses can be thought of as tension or compression springs fastened to the part. This analogy makes stress analysis much simpler, giving us a clearer insight into the nature of the stresses and often their cause.

In Fig. 4 we have several of the almost limitless number of possible stress combinations. Fig. 4a represents a straight beam with crosspieces attached to each end. It is readily apparent that if a tension spring is placed between the crosspieces at opposite ends of the beam, the beam would bend as shown in 4b. Conversely, if a compression spring were used the beam would bend as shown in 4c. Using this spring analogy, we can synthesize any combination of tensile and compressive stresses on our beam and determine the direction of beam deflection.

Other likely combinations include that shown in 4d, in which a tensile and a compressive force are added

to the same side. If the stresses are of the same magnitude the part will remain straight. This condition could lead to the false conclusion that the part is stress-free. If tensile forces of the same magnitude are added to opposite sides of the beam, as in 4e, there would be no deflection. This again could lead to the assumption that the beam is unstressed. Compressive forces of equal magnitude, if placed on opposite sides of the beam, as in 4f, would give the same result. In 4g we see what would happen if a tensile force were added to one side and a compressive force to the other. Here both forces tend to move beam in same direction.

As previously mentioned, there are many possible combinations and orientations of residual stress. However, all of them can at least be analyzed and partially understood through this simple spring analogy.

Causes of residual machining stresses

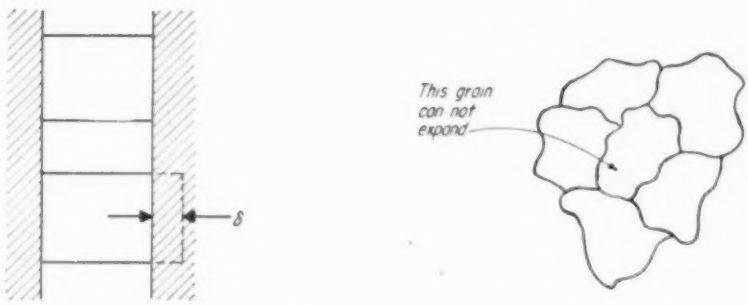
It is fairly safe to say that all residual stresses are traceable to either thermal or mechanical causes, but here we will discuss residual stresses only as they relate to machining operations.

Thermal causes

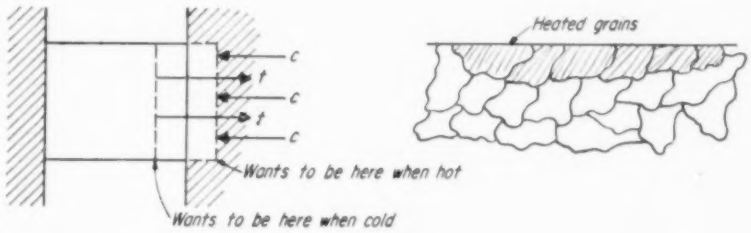
Thermal transformation — Most metals change volume when they go through any allotropic state change. For example, when a pound of steel is in the fully hardened martensitic state it occupies a greater volume than it did in the softer states. This is similar to the common example of water taking up a larger volume when frozen than when liquid. Thus there are many possibilities for machining, and especially grinding, to cause thermal transformation. **When these changes take place locally, rather than in the whole workpiece, the result can only be residual stress.**

Think of a single grain of metal as the one that is undergoing transformation. It is held tightly and restricted from moving by its surrounding grains (Fig. 5), so that when it tries to expand it is left in compression. If it is trying to contract, it will be left in tension.

Transformation during machining can occur for any one, or a combination of reasons. One of the more common causes is the tempering of martensite by the heat generated in machining or grinding. This transforms the surface material and brings about a change in volume. Another cause of transformation is the quenching effect that can take place when a surface that has been highly heated (above transformation temperature) by the machining is cooled by the surrounding mass of cold metal as the tool passes on. If the material were steel, it would be possible to quench it to a martensitic state, again with the attendant volume change. Between the martensitic area and the original metal structure there would be a transition zone, the structure of which would depend upon the thermal gradients present.



5. Thermal transformation . . .
of a material to a phase in which it occupies a greater or lesser volume will cause residual stresses in the material. Imagine a single grain that is being hardened to the martensitic state. It tries to expand but is restricted by its neighbors, and so is left in compression



6. Upsetting from thermal expansion . . .
is a common cause of residual stress. The heated part tries to expand, is restricted by the walls, and begins to upset as the yield strength of the part is exceeded. This permanently shortens the part, and when it cools and tries to contract, it is left in tension. Heated metal grains undergo the same cycle

Mechanical upsetting from thermal expansion—This is perhaps the most common cause of thermally induced residual stresses.

Visualize a piece of metal welded rigidly between two immovable walls, as in Fig. 6. If the metal is heated it will try to expand; but since it cannot expand, it goes into compression. As soon as the yield strength is exceeded, the piece will start to be permanently upset, or shortened. What happens now when the heat is removed? The part cools down, but is now too short to fill the space between the walls and, since it is rigidly attached to them, it is left in tension.

Exactly the same thing happens when a surface is heated by machining or grinding. The surface cannot expand freely because of the neighboring grains which surround it, and so it upsets. When it cools, it is left in tension.

In actual practice, thermal transformation and thermal expansion can, and often do, take place simultaneously.

Mechanical causes

Superimposed upon the thermal effects is the mechanical action which takes place during any machining operation. All normal cutting and grinding operations exert a finite

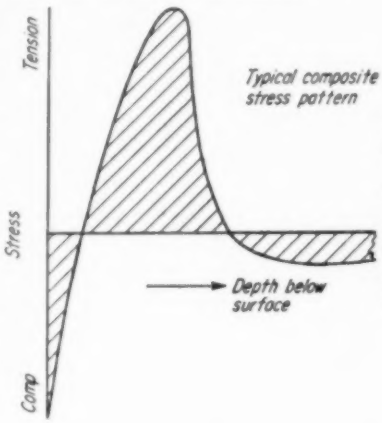
amount of force, and this force is transmitted by the tool into the workpiece.

Machining operations can be likened to peening one side of a metal bar (Fig. 7). The peened portion tries to elongate but cannot since it is restricted, or at least partially restricted, by its neighboring grains. As a result, the peened area goes into compression.

Extremely complicated reactions take place when both thermal and mechanical effects are superimposed on the same surface. Unfortunately, this is normally the situation in machining. The resultant residual stress (Fig. 8) is the composite of the two effects.

The typical stress pattern shown in Fig. 8 represents a part with a compressive stress at the surface. This compressive stress drops off below the surface until an unstressed layer is reached. Beyond this unstressed layer you will find a tensile stress that rises to a peak, then tapers off and goes to zero. Then compressive stresses appear again. Such a pattern results from combined thermal and mechanical stresses.

7. Cutting operations exert force . . .
and this force is transmitted to the part by the tool. Machining can be likened to peening one side of a part. The peened section tries to get longer, is restricted by surrounding grains, and so goes into compression



8. Typical stress pattern . . .
is the resultant of the thermally induced and mechanically induced stresses. This particular pattern depicts a part that has a compressive stress at the surface. This stress tapers off below the surface until you reach a layer that is unstressed. As you go deeper you find a tensile stress that rises to a peak, then drops off and goes to zero. Then compressive stresses appear again

How to detect and measure residual stresses

As yet there is no one entirely satisfactory method of detecting and measuring residual stresses in finished parts. There are many methods being used; each will be discussed briefly.

Distortion of part

If a part is machined to a dimension while held in the fixture, and if it exceeds that dimension when removed, this is clear evidence of the action of residual stresses. One way of measuring stress from a particular machining operation is to machine one side of a flat, stress-free specimen and measure the stress as a function of the amount of bending (Fig. 9). While this gives only an approximate answer, and can lead to some false conclusions, it is entirely satisfactory for many purposes.

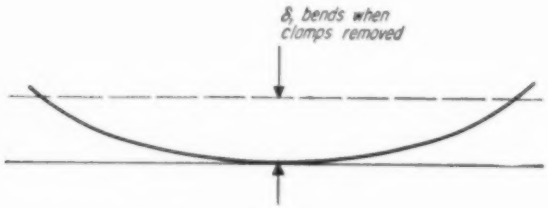
Mechanical relation

If the flat strip is stressed, the stress can be calculated by removing successive thin layers of the surface by chemical or electrochemical etching (Fig. 10). As each layer is removed there will be a change in deflection. When no further deflection is noted, the stressed area has been removed. The data recorded can then be used to calculate the average stress in each layer removed, yielding a complete history of the stress as a function of depth.

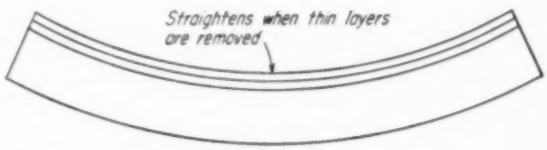
X-Ray diffraction

Grains of metal have different interplaner spacing under different conditions of residual stress. In tension, the spacing is greater; in compression, less. When an X-ray beam is diffracted from the stressed surfaces, the angle of diffraction changes as a function of the interplaner spacing, and can be used as a measure of the residual stress (Fig. 11).

X-ray is limited in application for several reasons. First, only extremely superficial (shallow) surface stress can be detected. Moreover, it is lim-



9. Residual machining stress . . .
generated by a particular machining operation can be determined approximately by machining a flat, stress-free specimen and measuring the stress as a function of the amount of bending



10. Stress can be measured . . .
through removal of successive, thin layers of the material by chemical or electrochemical etching. As each layer is removed there will be a change in deflection. In this way, you can get a complete picture of the stress as a function of depth

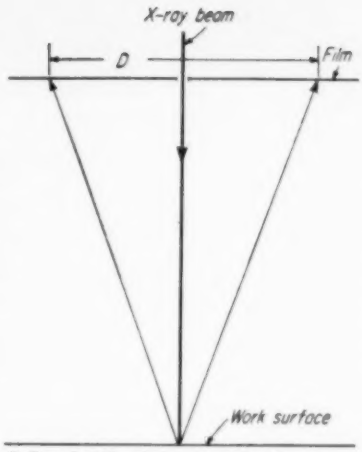
ited physically because it can be used only on a flat surface, at least ⅛ in. wide, that can be "seen" by the incident and diffracted rays. This prohabits its use on radii, which are usually areas of high stress. It is usually not very accurate on cold-worked surfaces because the cold working also affects the interplaner spacing—and, unfortunately, most machined surfaces are cold worked. Another major problem is the long exposure time. This, coupled with the expensive equipment and know-how required, makes X-ray a rather expensive technique, and it is mainly limited to research applications.

Visual damage

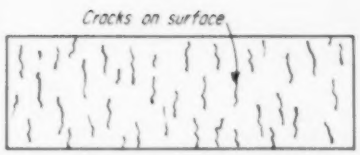
Almost everyone has seen parts that are cracked or checked after machining or grinding (Fig. 12). This is merely the manifestation of a stress that exceeded the strength of the metal.

Stress corrosion

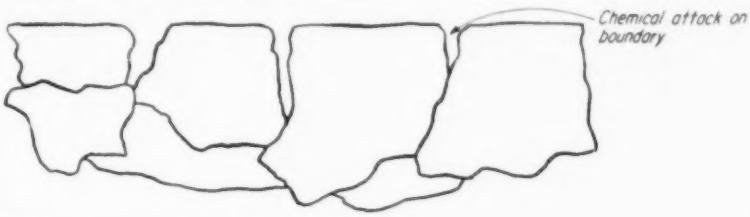
A piece of metal in tension is more susceptible to grain-boundary attack from chemicals than a piece in compression. Thus, the part which is under high tensile stress will suffer rapid attack when subjected to chemical action (Fig. 13). The forces holding the grains together will be weakened, often weakened enough to allow progressive cracking of the surface.



11. Diffraction of an X-ray beam . . . from a stressed surface can be used to measure residual stress level. The diameter D of the diffracted ring changes with the stress condition



12. Cracked or checked parts . . . are evidence of residual machining stresses that exceeded the strength of the material. Close attention to the points brought out in the text will minimize, possibly prevent such stresses

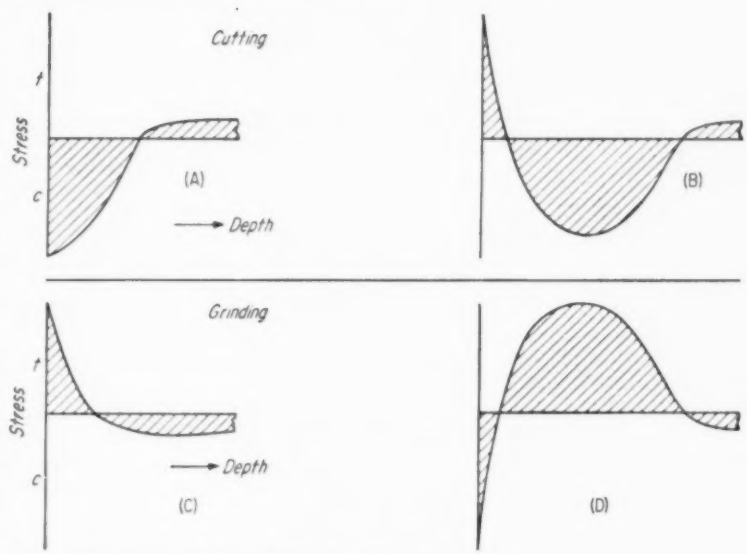


13. Tensile stress invites stress corrosion . . . when a part is subjected to chemical action. The tensile forces tend to weaken the bond between the grains, thus permitting rapid chemical attack. Cracking is often visible

Magnitude of residual machining stresses

The stress diagrams presented in Fig. 14 are meant to convey a rough idea of the distribution and magnitude of various residual machining stresses. They are examples only, and should be considered in this light.

As we mentioned earlier, the residual stress in a workpiece is usually the composite result of the thermally induced and the mechanically induced residual stresses. And, as we said, the result is quite complex. A cutting operation usually produces a compressive stress on the surface (14a), the magnitude and depth of the stress depending upon the machining operation and the material. In some cases we can even get a tensile stress on the surface (14b), though the stress will normally not be as great or as deep. Grinding operations generally produce a tensile stress on the work surface (14c), though, once again, we can get a compressive stress (14d). These diagrams also show that ten-



14. Residual machining stress patterns . . . give a rough idea of the shape and magnitude of the stresses induced by cutting and grinding. Cutting usually leaves the surface in compression (4a); grinding usually leaves it under tension (4c). As you can see, the reverse may also occur (4b and 4d)

sile and compressive stresses can be present simultaneously in adjacent layers. This is what normally takes place in a machining operation. (See Fig. 8, p140.)

Peak stress levels

It is impossible to state exact peak stress levels for different types of materials. Certainly it is possible to exceed the rupture strength of the material, as evidenced by the many times when cracks actually occur. Here are some typical residual machining stresses in different alloys:

- low-carbon steel..... 70,000 psi
- high-strength steel ... 180,000 psi
- high-temp. alloy ....200,000 psi

The extreme stresses possible with residual stresses are quite different from those with applied stresses; it is not uncommon for residual stresses to exceed the bulk yield stress of the material.

Different processes and variations of the same process can produce stresses that vary in their depth of penetration. For example:

grinding .....0.005-0.010 in.
cutting .....0.010-0.020 in.
shot-peening .....0.010-0.025 in.

These figures might be termed "maximum" under ordinary conditions, but they could be exceeded by a considerable amount in extreme cases.

Residual stresses affect size and strength of part

All the foregoing discussion would be meaningless if there were not an understanding of why we are so interested in residual machining stress. There are two main reasons: Residual stresses affect dimensional stability and lower the fatigue strength of finished parts.

Dimensional stability

Stresses during machining — In most machining operations the part is clamped so that it cannot move in the fixture. If, however, a high residual stress is imparted to the surface during machining, the effect can be catastrophic when the part is removed from the fixture. A 6-in.-long plate, ⅛ in. thick, can bend as much as 0.075 to 0.100 in. Thus, stresses built up during machining can cause considerable warping and bending of finished parts. This is especially true of aircraft and aircraft-engine parts, which are usually quite light in cross-section and, hence, are affected to a greater degree by the same surface stress.

Stresses relieved by machining—Many times a part is stressed quite highly after heat treating or forging. When such a part warps during machining, you may think that the machining has caused the damage. More often then not, the machining has merely removed some previously stressed material, unbalancing the internal stresses and causing the part to warp. After some experience, one can tell whether the warping is the result of machining or of prior operations.

Many shop people say that parts are more subject to residual stress on finishing cuts than on roughing operations. Evidence would seem to back this theory, but this effect, too, is sometimes the result of removing stresses imparted by the previous rough-machining operation. Again, if we use our spring analogy, we can often isolate these effects and determine whether the trouble is "past" or "present."

Stresses relieved in storage—In some metals these internal stresses relax quite rapidly. As a result, a finished part may change dimensions during storage. Ordinarily this change will not be detected, nor will it really matter; but on parts where close tolerances must be held, this can be a real troublemaker.

Stresses relieved during use—There is a tendency on the part of fatigue-loaded pieces toward self-relaxation of residual stresses. If the relieving action or the original stress is not perfectly balanced about the load axis, the part will warp during use. This is a frequent cause of parts not passing dimensional inspection after they have been in operation.

Fatigue strength

Lowered fatigue strength is one of the worst effects of residual stress. In addition to a steady load, most parts also carry a superimposed intermittent load, and it has been determined that the fatigue strength, or the amount of stress that the part can withstand indefinitely under intermittent loading, is greatly lowered in many alloys when residual stress is present. For example, recent tests at General Electric show that a stress-free sample of M-252 alloy has a fatigue strength of 52,000 psi, while a sample with a moderate residual tensile stress has a fatigue strength of only 30,000 psi.

How to control residual stresses

Residual stresses can be controlled in several ways. It is not always necessary that all traces of residual stress be removed. Close attention to the following points can often keep these stresses at a negligible level.

Heat treatment

Heat treatments that will leave a material stress-free can be developed in but one way—heat treat small strips or coupons of the material and then analyze them for stress conditions. Even this may be misleading, since the geometry and section thickness of the parts affect stress distribution. Improper clamping during heat treatment can also cause distortion.

It is always possible to relieve, or at least partially relieve, stresses prior to or after finish machining. Such treatments are not always practical, for in many cases the temperatures involved are so high that the part may be softened or, in the case of a completed part, the finish may be impaired. Here again, though, the coupon analysis can determine the temperatures necessary to effectively relieve the residual stresses.

Proper machining

Clamping the work—There is a tendency in production today to try to machine everything in a single setup, that is, to rough and finish on one side, then turn over and rough and finish on the other. And then expect the part to be flat or hold the same dimensions as in the fixture. Whenever dimensions must be held closely, the work should be done progressively, that is, shim under the loose spots and clamp it in what is

essentially the free position. This way may require more finishing operations, but at least the parts will meet specifications.

Tool feeds—The feed of a single-point tool has an important effect on residual stress. When you are machining a work-hardening alloy, too low a feed tends to increase the residual stress, as does too high a feed. In general, the effect of feed on residual stress can be seen in Fig. 15. In our work with the austenitic high-temperature alloys, the optimum feed seems to be about 0.010 in. per rev.

Tool sharpness—This is probably the most important factor in minimizing residual stress. Sharp tools are absolutely essential, and by a sharp tool we mean a tool with less than a 0.010-in. flank wear land (Fig. 16). This is especially important on work-hardening alloys.

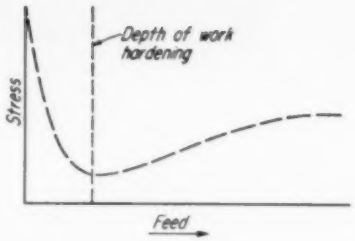
Experience over the years has shown that a dull tool will cause many times the distortion caused by one that is properly sharpened and not used beyond 0.010-in. wear land.

Tool geometry — Rake angle is apparently second only to tool sharpness in importance. There are probably many exceptions but, in general, if tool forces are high then residual stress is high. And, in general, negative-rake tools tend to produce much higher stresses than positive-rake tools (Fig. 17).

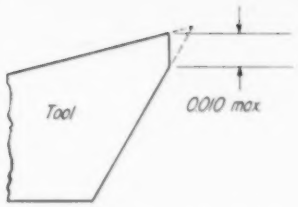
Though there is no direct quantitative proof that the lead angle and the type of point are important, many practical examples have yielded much qualitative data. The amount of work hardening and, hence, the residual stress are tied closely to the lead angle and the type of point in the machining of high-temperature alloys. It seems reasonable to assume that similar conditions exist for the more commonly used materials.

The point that has been found best, from a standpoint of stress, is shown in Fig. 17. This exact point is not absolutely necessary, but the tool should have a positive top rake, a high lead angle, and an obtuse angle at the point. What is important is that the tool point rub as little as possible on the machined surface. Instead, as much contact as possible should be made on the chip surface.

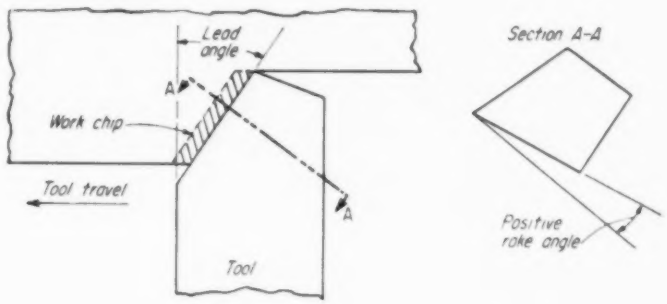
Depth of cut—Within reasonable limits, depth of cut does not appear to be of major importance. Nevertheless, extremely shallow cuts should be avoided on work-hardening materials (Fig. 18). A reasonable limit for depth of cut would be from 0.015 to 0.040 in. for work-hardening alloys and from 0.005 to 0.040 for non-work-hardening alloys. One prime rule—don't take too little on your finishing cuts.



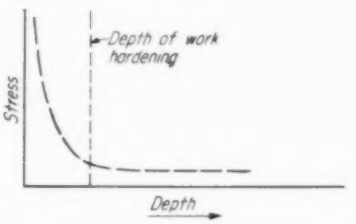
15. Too high or too low a tool feed . . .
will increase the residual stress in work-hardening alloys. For austenitic high-temperature alloys, the optimum feed is about 0.010 ipr



16. Sharp tools are absolutely necessary . . .
for low residual stresses in machined surfaces. A sharp tool means a tool with less than 0.010 in. flank wear land. This is especially important on work-hardening alloys



17. Tool geometry is important . . .
and ranks second only to tool sharpness as a key to low stresses. Tool should have a positive top rake, a high lead angle, and a point that minimizes rubbing on the machined surface. Positive-rake tools produce much lower stresses than negative-rake tools



18. Depth of cut has little effect . . .
providing you take enough to get beneath any work-hardened layer. Practical limits seem to be from 0.015 to 0.040 in. for work-hardening alloys; from 0.005 to 0.040 in. for other materials

Cutting speed — Though cutting speed itself does not have a major effect in minimizing residual stress, there are some secondary practical effects which are extremely important. The speed must be high enough to maintain a cutting-tip temperature above the annealing point of the material. Otherwise, a built-up edge will induce excessive stresses into the material and cause periodic tearing and surface damage. If the tip temperature is high enough, the formation of a built-up edge can be minimized and sometimes completely eliminated.

High speed is damaging only insofar as its effect on tool wear. Too high a speed dulls the tool rapidly; but if a high speed can be maintained without excessive tool wear, it is not harmful. Some people say that it is beneficial, because the forces are generally somewhat lower at the high speeds.

Rigidity of setup — You cannot machine a part in a flimsy, non-rigid setup without inducing residual stresses. There is always some "spring" away from the tool, but it

must be minimized—the setup must be as rigid as possible. When the work yields under the tool, the tool is not cutting, it's rubbing. And the rubbing can cause work hardening and premature dulling of the cutting tool.

Even if dulling and work hardening are not problems, excessive flexure of the work is bound to leave a stressed condition. The work must return beyond where it was when it was being cut, and close dimensional control is impossible.

For lower stresses:
- **Use sharp, positive rake tools**
- **Use tools with high lead angles and non-rubbing points**
- **Use the most rigid setup possible for the operation**
- **Use medium feeds and cuts**

Some practical problems and solutions

To show that this discussion is not simply an academic exercise, let's look at a few actual experiences with residual stresses and see how the problems were solved.

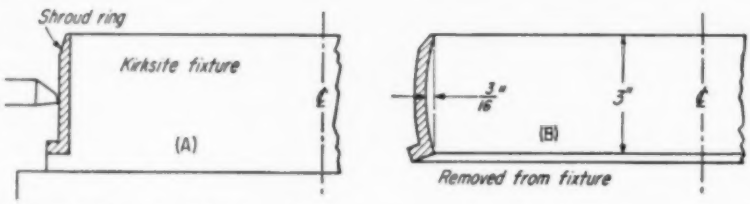
Disks or plates

Facing of disks and plates is a fairly common operation. But thin disks, such as compressor wheels, present trouble. For the facing operation, the disks are usually backed up by plastic or low-melting matrix, or a suitable chuck. Today, vacuum chucks are often used for this purpose. The residual stress manifests itself after the part has been removed from the chuck, most often by springing out at the center or, as it is called, oil-canning.

In cases of extremely severe residual stresses, the part may oil-can during the machining operation, which, of course, further complicates the dimensional problems. The degree of oil-canning can vary considerably. For example, a 24-in.-dia wheel may spring a few thousandths or it may spring ¾ in., depending upon the residual stress level and distribution.

If the bending is out toward the side which was machined, it is fairly safe to say that the stress is the result of the finishing operation. If, however, the part moves away from the tool, the trouble is probably the result of relieving high residual stresses prior to the finishing operation. It is usually compressive forces that cause oil-canning. If the part moves toward the tool, compressive forces on the tool side are indicated; if it moves away, the general indication would be that tensile stresses were present. But since tensile forces are usually too small to cause appreciable bowing (though the tensile stresses imparted by the cutting tool may be high), the cause is most likely to be the removal of compressive forces remaining from prior operations.

Oil-canning can be minimized by:
- Progressive machining, that is, don't try to rough and finish at a single setup, but use as many steps as necessary.
- Making sure the setup is rigid through use of vacuum chucks or a rigid back-up matrix.
- Running at a high enough speed to prevent a built-up edge, but watching out that tools do not become dull too quickly.
- Using positive-rake tools of proper geometry.



19. Distortion in this shroud ring . . . was caused by stresses set up as a result of machining with a dull tool. Tool also had the wrong lead angle for machining the sharp fillet radius near the bottom of the ring. Part was originally made from a fairly easy to machine material; when a tougher material was used, tool dulled at very beginning of cut. Problem was solved by reducing the cutting speed and changing the tool geometry

Shroud rings

An actual case history exists that will illustrate all the foregoing principles and discussion. The part in question was a shroud ring machined from a ring forging. The forging was first faced top and bottom, then bored to finish size, and placed on a rigid Kirksite fixture, as shown in Fig. 19a. Then the entire outside diameter was machined. Now this procedure was entirely satisfactory when the ring was made from a fairly-easy-to-machine material. However, when the specification was changed to a hard-to-machine material, the trouble really began.

The new material dulled the tool so rapidly that the outside diameter, for the most part, was machined with a dull tool. The tool also had the wrong lead angle for machining of the sharp fillet radius near the bottom of the part. When the machined part was removed from the fixture (Fig. 19b) it bowed 3/16 in. The problem was solved by changing tool geometry and decreasing the speed sufficiently to permit the entire outer surface to be machined without excessive dulling of the tool.

Flange distortion

Light parts with flanges tend to distort readily. Common practice is to face a flange in the unrestricted state so that it is perfectly square, then bring it to thickness by facing the back face of the flange. Many times the face does not remain flat because a residual stress has been added to, or sometimes removed from, the back face. This can be prevented by following all the precautions for low residual stress conditions and by carefully taking a preliminary finish cut on both sides of the flange. The same care should be taken with this preliminary finish cut as with the final cut.

Residual stresses should no longer be a complete mystery. With the basic ideas presented here and a little common sense, you should be able to minimize this problem

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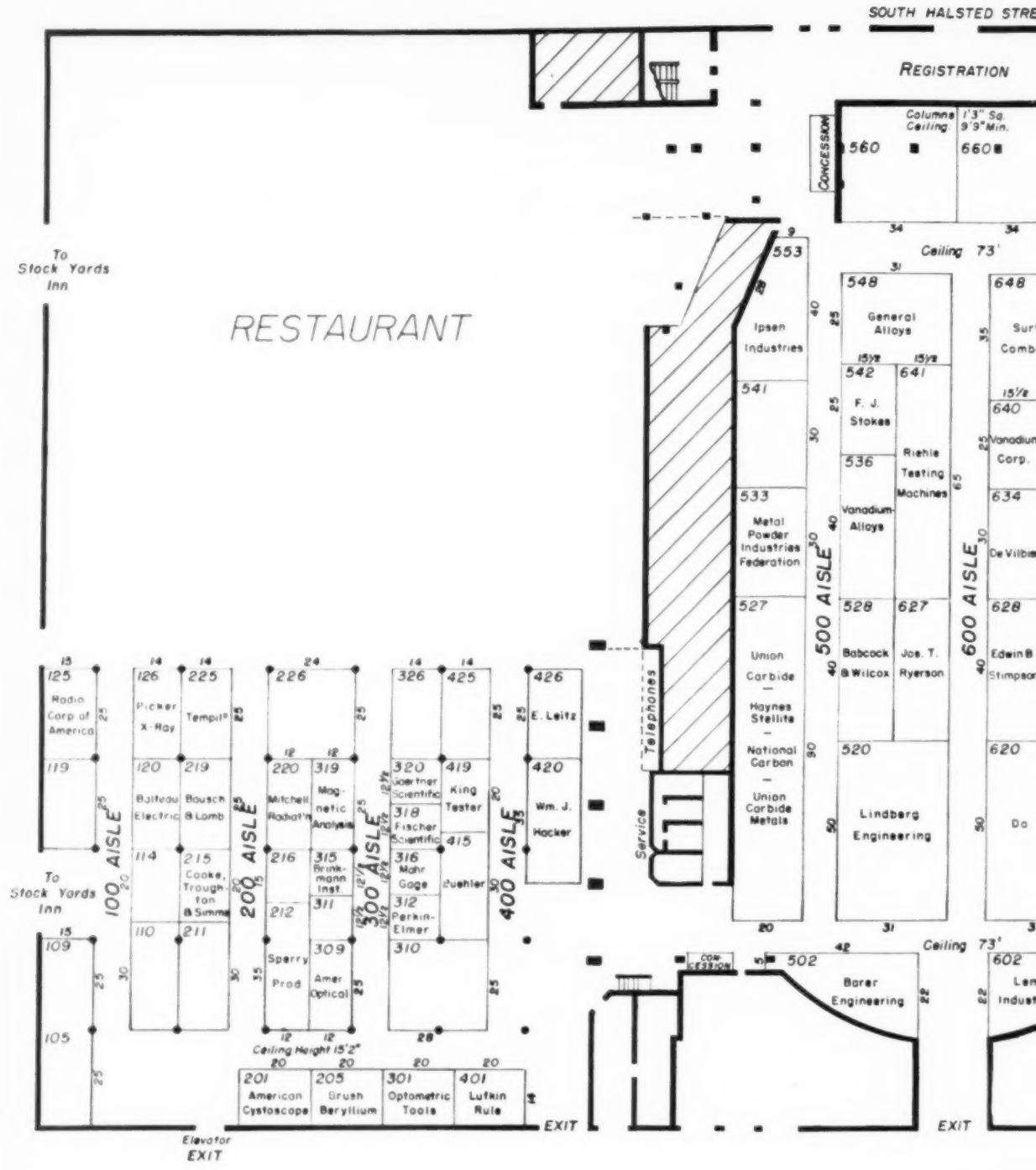

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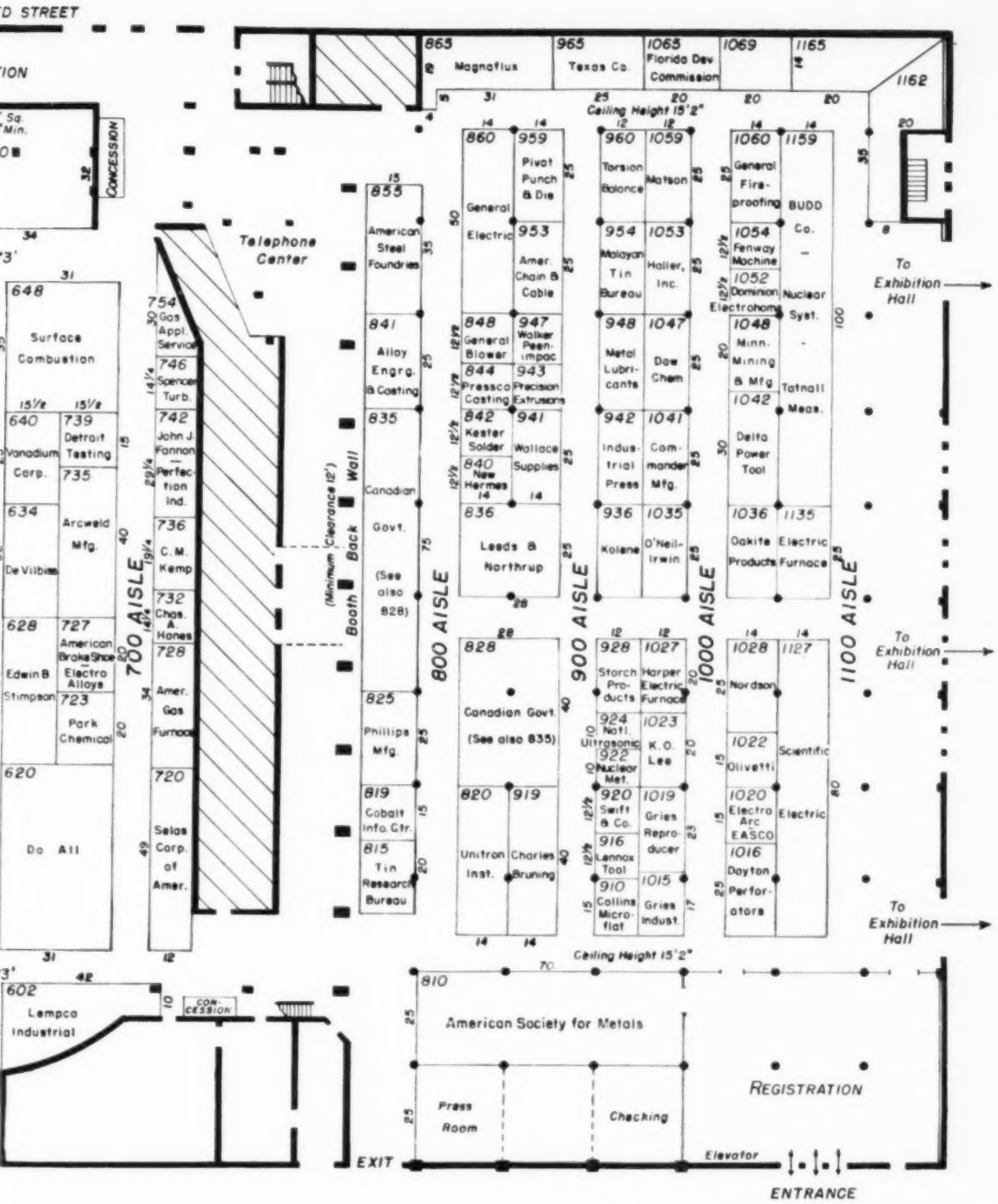

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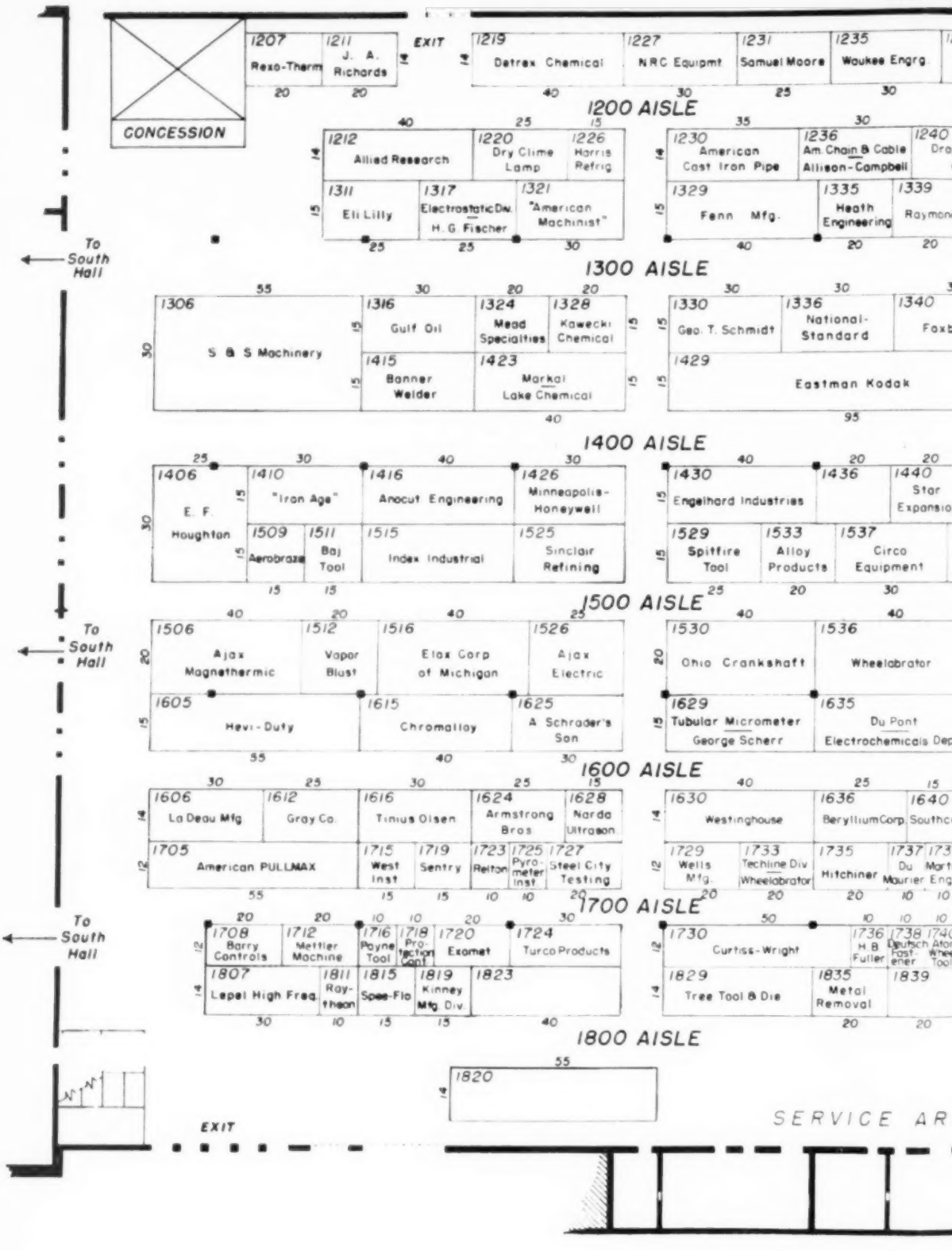
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Roundup of Technical Programs

Dovetailing technical programs at the 41st National Metal Congress in Chicago next month with those of the sponsoring American Society for Metals will be seven national technical societies: American Institute of Mining, Metallurgical and Petroleum Engineers; Society for Nondestructive Testing, Special Libraries Association, American Society for Testing Materials, Metal Powder Industries Federation, Metal Treating Institute and Ultrasonic Manufacturers Association. In all, 275 technical presentations will be made.

ASM to present 52 papers

Highlighting ASM's five-day technical program will be a series of seminars, William Park Woodside Panel Conferences, and presentation of 52 technical papers.

ASM's program will kick off with a pre-Congress seminar on resonance and relaxation in metals Saturday and Sunday, October 31 and November 1 at the Hotel Sherman.

Opening day, Monday, November 2, will begin at 9:00 am in the Sherman with concurrent sessions on steel and titanium. In the afternoon will be a session on high strength steels.

Tuesday's program will open at 9:00 am with sessions on steel and on creep and deformation. Afternoon will see presentation of papers on physical metallurgy.

There will be no technical sessions Wednesday morning. Afternoon will be devoted to mechanical working.

Thursday will start with morning sessions on nuclear metals (chaired by experts from Oak Ridge and Los Alamos) and austenitic alloys. Afternoon session will be on refractory metals.

A symposium on rare earths and related metals will be held under American Society for Metals and Atomic Energy Commission sponsorship mornings and afternoons, Monday and Tuesday, November 2 and 3, in the Hotel Sherman's Bal Tabarin.

William Park Woodside Panel Conferences will be held mornings and afternoons, Monday through Thursday. Monday's morning and afternoon sessions will cover composite materials. Tuesday's will be on explosive forming, Wednesday's on refractory metals (afternoon only), and Thursday's on new fabricating techniques and materials.

Three divisions of AIMMPE (Institute of Metals, Iron & Steel, Extractive Metallurgy) will hold sessions Monday through Thursday at the Morrison Hotel.

Monday sessions will cover kinetics of phase transformations, preparation and properties of refractory metals, diffusion, metal processing, creep and fatigue, and thermodynamic properties.

Tuesday's program: mechanical properties of non-metals, titanium vs steel, developments in steelmaking, refining.

Wednesday's—surfaces and quantitative metallography, titanium, precipitation and dispersion hardening.

Thursday's — refractory metals, oxidation and reduction.

SNT Educational Clinic

Society for Nondestructive Testing will climax five days of sessions on Friday with an Educational Clinic on radiography, dark room techniques, fluoroscopy, magnetic particle inspection, penetrant inspection, eddy current test methods, theory and application of ultrasonics, and writing in modern technology. Monday-through-Thursday sessions at the Hotel Hamilton will cover new instrumentation and techniques, nondestructive testing correlation with fatigue testing, component reliability, nuclear component reliability, and inspection of brazed honeycomb.

Metal Treating Institute will hold a single session Thursday, November 5 at 2:00 pm in the Sherman's Assembly Room. First, a panel will discuss heat treatment of gears, then will come a talk on obtaining specified requirements through heat treating, and another on carbon control during heat treatment.

Also in the one-session category is Ultrasonic Manufacturers Association, which will hold it Thursday morning at the Sherman. The session will present three papers covering non-inspection techniques (especially ultrasonics) as a medium for joining, cleaning, hardening, welding, soldering, brazing, drilling, machining and grinding.

Special Libraries Association (Metals Division) will hold its fall meeting Thursday and Friday. Thursday morning will see presentation of papers at the University of Chicago's Institute for the Study of Metals, followed by a tour of Argonne National Laboratories, and a dinner Friday will see a session at the LaSalle Hotel featuring papers on steel strapping and methods of applying it to packaging, followed by an afternoon tour of Acme Steel Co, Riverdale, Ill.

American Society for Testing Materials' participation in the Congress will be confined to a special series of meetings for four of its major committees at Chicago's Bismarck Hotel.

1959 Metal Show in Print

New Metalworking Equipment

Products described here will be introduced at the Metal Show and will be displayed with many others previously described in American Machinist

Automatic Cutoff Saw Featured In DoAll New Product Lines

A new line of automatic cutoff saws will be featured in DoAll's lines of new products which include a line of stainless steel gage blocks, electronic inspection instruments, a small precision surface grinder, and redesigned lines of Contour and Contourmatic band machines.

The new Model C-67 and C-68 power saws, designed specifically for the Demon HSS saw band, are said to have greater accuracy, operator convenience, and higher production rates than the models they replace. C-68 has 12 x 12 in. capacity and automatic stock indexing. C-67 has 12 x 16 in. capacity and the stock is manually fed. A job selector mounted on the machine lists over 200 materials and the correct band size and pitch, band speed and coolant mixture, and anticipated cutting rate for each.

The stainless steel gage blocks are said to have a longer life of dependable gaging accuracy because of the properties of the stainless. The blocks have the same coefficient of expansion as steel blocks and may be used interchangeably with them.

Trans-Check instrument provides a relatively fast, easy-to-use method of determining surface plate flatness. Micro-Check comparators feature absolute dependability for calibration and inspection, and are calibrated in millionths.

DoAll Co, Des Plaines, Ill

MORE DATA? Circle 123, inside back cover

Instruments Test Honeycomb, Magnetic, Non-Magnetic Parts

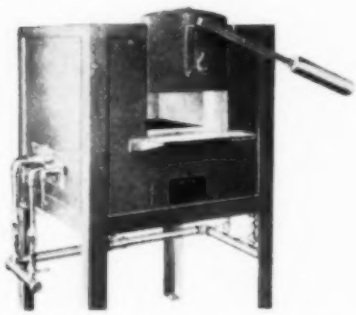
Bondcheck BC-2 test accurately locates and permanently records lack of bond, excessive braze, crushed or deformed core, excessive or insufficient fillet radiuses, and other irregularities in brazed honeycomb sandwich. Both flat and curved shapes can be inspected at production speeds. Permanent file records are readily made by photography. Method uses a heat-affected fluid with automatic control of speed of inspection, heat application, and conveyorized spray devices.

Magnatest FS-300 (illustrated) rapidly evaluates and sorts magnetic parts for such metallurgical properties as alloy variation, heat treat condition, hardness, cold working brittleness and tensile strength. The dual coil instrument sorts bearing balls, bearing races, piston rings, bolts, and other items by placing a acceptable part in one coil and passing parts to be inspected through the other coil. Metallurgical differences show up as differences in the wave form on the cathode-ray tube.

Magnatest FM-110, battery powered and transistorized, measures electrical conductivity in absolute units and serves as an accurate method for determining hardness, alloy, heat-treat condition, and tensile strength of non-magnetic metals.

Magnaflex Corp, 7300 W. Lawrence Ave, Chicago 31, Ill

MORE DATA? Circle 124, inside back cover



Buzzer Heat Treating Furnaces Now Available up to 2400 F

Model 1218 high-temperature floor-type oven furnace is now available in a modified hearth-type unit for operating temperatures over the previous 1850-2000 F limit. Unit is capable of operating in the 2250-2400 F range using quiet, atmospheric gas burners. Furnace can be supplied with a muffle for inert atmosphere applications, and it is now available as a special sealed unit, in four sizes.

Charles A Hones, Inc, 121 S Grand Ave, Baldwin, LI, NY

MORE DATA? Circle 125, inside back cover

Heavy Duty Blast Cleaning Barrel Handles 500-lb Castings

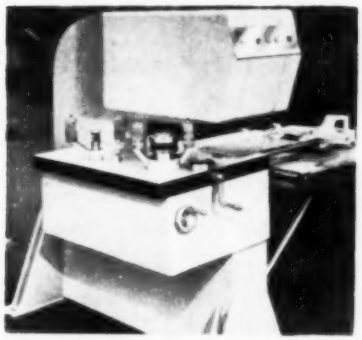
The 15-cu-ft Rotoblast barrel is said to provide the first heavy duty barrel type of medium size to clean castings weighing as much as 500 lbs each. It can handle a total batch load of 2700 lbs.

Available with standard, semi- or fully automatic controls, the unit uses a 30-hp Rotoblast wheel which delivers 50,000 lbs of abrasive per hour. Interior is made of wear-resistant steel plates, said to last up to 100 times longer than mild steel.

Conveyor tension can be adjusted from the outside without dismantling or unloading. New conveyor design is claimed to be virtually jam proof. Blast cabinet is made of welded steel plates and has a jam-proof, two-piece barrel door which travels on rollers in labyrinth-sealed guides.

Pangborn Corp, Hagerstown, Md

MORE DATA? Circle 126, inside back cover



High-Speed Punch Press Has 30-in. Throat Depth

Super 30 Fabricator is a single-station high-speed punchpress with a throat depth capacity of 30 in. For straight line punching it will handle a 30-in. workpiece of any length using a multiple-stop gaging system.

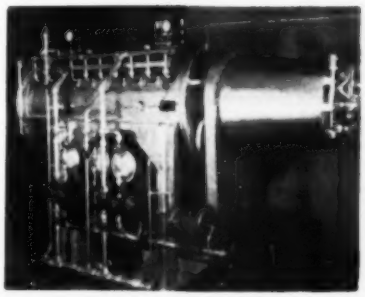
For production punching with the Strippit Duplicator, its maximum work size is 25 x 30 in. Hole punching capacity ranges from a 3½ in. hole in 16 gage mild steel to a ½ in. hole in ¼ in. mild steel with a tolerance of ± 0.005 in.

It will handle 90° corner notching up to 5 x 5 in. in 16 gage mild steel as well as rectangular, radius, vee, and specially shaped notches. The machine will do straight line nibbling and contour shearing at 165 spm with a capacity of ⅛ in. mild steel. A single switch permits instant changeover from single stroke punching to nibbling. Punch and die sizes can be changed in 20 min.

The new electric head has 30 less parts than formerly.

Wales-Strippit, Inc, 200 S Buell Rd, Akron, NY

MORE DATA? Circle 127, inside back cover



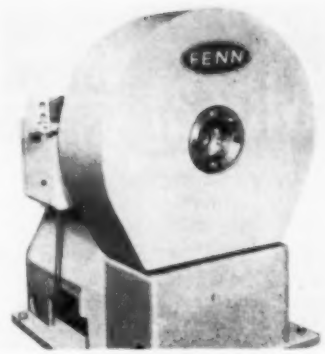
Automatic Continuous Furnaces For Heat Treating Small Parts

Model 136-MGD rotary retort furnace (illustrated) uses a new style automatic feeding hopper. The work is conveyed through the alloy retort by an internal spiral which advances the work through the heated zone. The work is discharged from the retort in the heating chamber through an atmosphere sealing hood. The furnace can be used for carburizing, case hardening, clean hardening and similar operations without modification. Capacity is 150 to 400 lbs per hour.

Also on exhibit will be the latest Model 231 controlled atmosphere shaker hearth furnace. The parts travel through a fully sealed muffle on a work conveying tray. The tray and workpieces are moved forward by a simple mechanical drive. This forward movement is then interrupted, causing the workpieces to advance along the tray by their own momentum. Capacity is 250 pieces per hour.

American Gas Furnace Co, 140 Spring St, Elizabeth, NJ

MORE DATA? Circle 128, inside back cover



Fenn Introduces Stationary Four-Die Swaging Machine

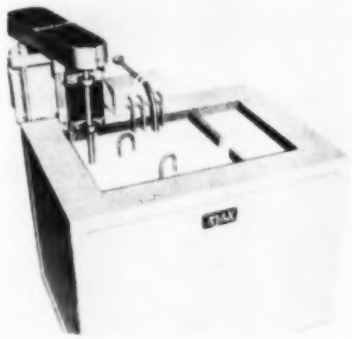
Stationary four-die swaging machine is designed for use where it is desirable to keep work from rotating, such as when swaging from round stock. The machine, which is said to offer quiet operation and a reduction of operator fatgue, will also swage other conventional pointing and forming operations from rounds.

Models are available to swage solids from 13/32 to 3⅜ in. and tubing from 1 to 6 in. Accessories include mandrels, brakes, work stops, quick-opening doors and coolant systems.

Also on exhibit will be the Fenn 5-in-1 wire line which draws, flattens, shapes, gages, and bundles into coils. It costs under $35,000 and has up to ⅜ in. entry dia and speeds up to 600 fpm.

Fenn Mfg Co, Newington, Conn

MORE DATA? Circle 129, inside back cover



Ajax Offers Salt Bath Cataract Quench Furnace

The Ajax salt bath cataract quench furnace will do everything that can be done in an agitated oil, according to the manufacturer. At temperatures around 750 F, it is said that results surpass those obtained by other methods. There is also no fire

1959 Metal Show in Print

New Metalworking Equipment

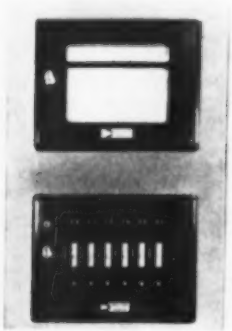
hazard. Furnace provides uniform hardness, elimination of quench cracks, and negligible distortion.

Quench flow velocities higher than previously obtainable are provided by a cylinder-like "header" in the center of the quench chamber. It is connected to a variable-speed pump. Work inserted into the header is exposed to a rush of highly concentrated molten salt that extracts the heat accurately and efficiently.

Other features include an automatic system for carrying off salt carried into the quench from a heating bath, and an automatic device which can add water to the molten salt at temperatures over 700 F.

Ajax Electric Co, 982 Frankford Ave, Philadelphia 23, Penna

MORE DATA? Circle 130, inside back cover



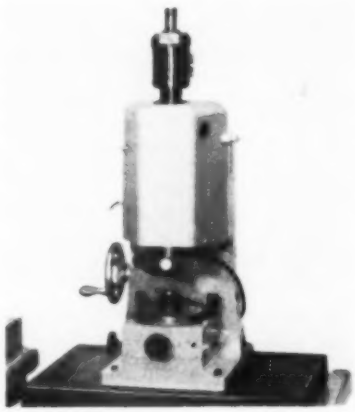
Recorder-Controller Combination Replaces Six Individual Units

Recorder - controller combination, which controls six points and records 24, is said to be capable of replacing up to six individual recording-controlling units.

Consisting of a multipoint recorder and controller, the instrument can operate from either one or two separate thermocouples or other inputs per point. There is positive protection against failures of either half of the system when the dual inputs are used. Both on-off and proportional electric controls are available.

Weston Instrument Div, Daystrom, Inc, 614 Frelinghuysen Ave, Newark, NJ

MORE DATA? Circle 131, inside back cover



Rotary Proficorder Offers Magnifications to 50,000X

Rotary Proficorder, designed to measure roughness, roundness, waviness, and total profiles, provides horizontal-magnifications up to 50,000X on a 4-in. wide strip chart. The instrument can make a chart record of roughness and waviness separately or a combination profile of both.

The tracer, a differential transformer type transducer, has a maximum displacement of 0.016 in. and a range of 1/32 to 3 in. OD and ⅛ to 8 in. ID. The diamond stylus has a 0.0005 or 0.0001 in. radius and 0.3 gram measuring pressure.

Circular tracing motion is provided by the pilotor which supports the tracer and tracer adaptor. It has a granite base plate measuring 18 x 24 x 2 in. and a 6 in. height adjustment.

The Rotary Proficorder can be used in combination with the previously announced Linear Proficorder because they can use the same Amplicorder and chart drive.

Micrometrical Mfg Co, 345 S Main St, Ann Arbor, Mich

MORE DATA? Circle 132, inside back cover

Leeds and Northrup Introduces Master-Slave Furnace Control

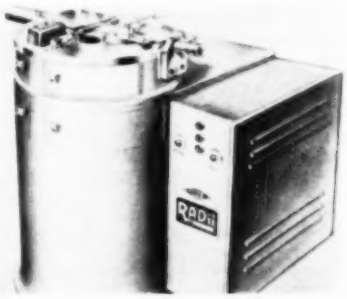
Master-slave program control system is designed for applications where temperature uniformity is of prime importance, such as brazing stainless steel honeycomb panels where temperatures must be held within ±5 or ±10 F.

As many as 24 zones may be controlled automatically by one master-slave programmer. The system is available with three-action PAT control for gas-fired furnaces or with three-action CAT control for continuous, stepless regulation of input to electric heaters or blankets.

Also on exhibit will be an accelerated cooling device for L&N's Steam Homo Furnace line. Designed primarily for atmosphere tempering and stress-relieving both ferrous and non-ferrous parts, it permits work to be furnace-cooled quickly under atmosphere protection.

Leeds and Northrup Co, Philadelphia 44, Penna

MORE DATA? Circle 133, inside back cover



High Speed Profile Miller Cuts Irregular Shapes in Seconds

McKay Radii high speed profile milling machine cuts simple radii and irregular shapes in seconds with no setup or layout.

Available in either a semi-automatic or fully automatic model, the machine can be operated without previous experience or training. The operator slips the material to be profiled into a vise and moves a handle through a 180° arc.

The semi-automatic model cuts simple radiuses. The automatic model will produce any profile within a 180° arc, milling true radiuses and irregular shapes.

McKay Machine Co, Youngstown 1, Ohio

MORE DATA? Circle 134, inside back cover

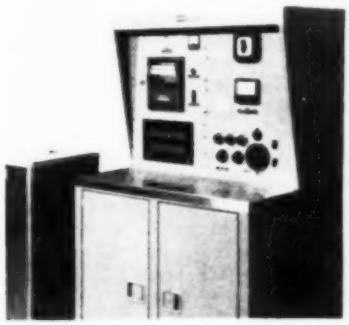
Agitating Action Added To Ultrasonic Cleaning

Unit which combines agitation and ultrasonic cleaning provides a degree of cleanliness never before available, according to the manufacturer.

The basket containing the work to be cleaned may be moved up and down by an air-activated lifting mechanism at variable rate of speed. A 500-w ultrasonic generator drives two 250-w immersible transducers mounted in the bottom of the tank. The level of liquid is carefully controlled so that a resonant situation prevails to contain a maximum amount of ultrasonic energy.

Circo Ultrasonic Corp, 51 Terminal Ave, Clark, NJ

MORE DATA? Circle 135, inside back cover



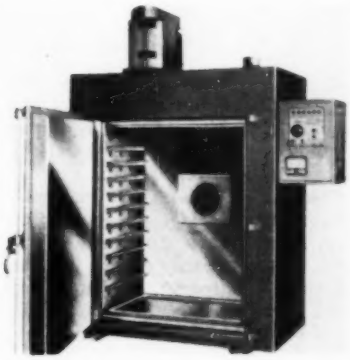
Arcweld Offers Creep Rupture Tester, Thermocouple Calibrator

Model M-3 creep rupture tester is designed to test smaller size specimens or use lighter loads. It has a 6000 lb capacity, 16:1 lever ratio, and automatic beam leveling device. Machine measures 20 in. deep by 30 in. wide by 78 in. high.

Model TC-2 thermocouple calibrator (illustrated) is equipped with potentiometer, standard cell, null indicator, wet cell storage battery, 24-point rotary switch for error-free switching from couple to couple, and a platinum/platinum-rhodium thermocouple calibrated by the Bureau of Standards on 12 points for temperatures to 2200 F. The calibrator comes complete with furnace.

Arcweld Mfg Co, Grove City, Penna

MORE DATA? Circle 136, inside back cover



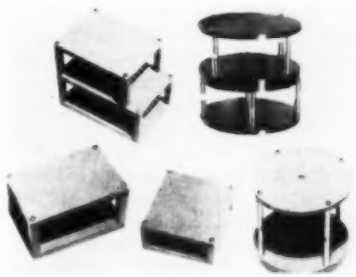
Batch Ovens Have 100-600 F Range

Blue M Series of industrial batch ovens, with Power-O-Matic control system and horizontal airflow, have a temperature range of 100-600 F.

The control circuit consists of a hydraulic thermostat with multiple flexible contacts. The contacts energize and de-energize each increment of the multiple heating element to provide automatic proportioning wattage control. Oven always operates at minimum wattage input in relations to temperatures and work load. It is said to save about 24% kwh input in comparison to conventional ovens.

Blue M Electric Co, 138th and Chatham St, Blue Island, Ill

MORE DATA? Circle 137, inside back cover



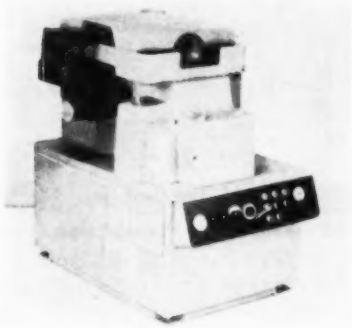
PIC Offers Instrument Plates, Coupling for Phasing Synchros

Precision ground instrument plates are available from stock in stainless steel or aluminum, 3/16, ¼, ⅜, or ½ in. thick. Round, square, and rectangular types are offered in a wide selection of sizes. Surfaces are flat and parallel to within ±0.0005 in. All six sides are ground to a 32 micro-inch finish, and all corners are square to within ±5 minutes.

Type T-9 and T-10 zero adjustable couplings provide precise rotational angular adjustment between two synchro rotors or other mechanical devices. One turn of the adjusting screw rotates one coupled shaft 12° and adjustments can be made through 360° in either direction. A screwdriver is the only tool needed. Coupling measures 1.862 in. long and 51/64 in. dia.

PIC Design Corp, 477 Atlantic Ave, East Rockaway, LI, NY

MORE DATA? Circle 138, inside back cover



Drill Pointer Automatically Grinds 0.032-1.5-in. Drills

Precision drill point grinding machine, for pointing drills from 0.032 to 1.5 in. dia, produces the conventional generated drill point, the Winslow Type 4 drill point, or varieties of similar points.

Four work heads are available and are easily changed to accommodate various ranges of drill diameters. Forms are generated by means of a combination of two cam movements. The drill point angle is formed on a 20-in. dia grinding wheel.

Production rate, which varies for sizes and types of drills, is about 20 per minute for small drills. The drill point on most drill countersinks can also be sharpened with this machine.

Features include an automatic, hydraulically operated wheel dresser; indexing system controlled at point of the drill to eliminate adjustments for variations in drill length; low-pressure coolant system.

Model 100 drill pointer can be supplied with motors for 220, 440, or 3-phase power. Grinder spindle is powered by a 1-hp motor and the hydraulic system by a 1½-hp motor.

Winslow Product Engineering Corp, 47 St Joseph St, Arcadia, Calif

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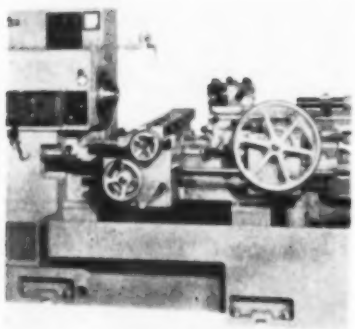
New Metalworking Equipment



Italian Turret Lathe Features Electromechanical Preselection

The Minganti (Italian) Model 50E automatic cycle turret lathe features an electromechanical preselection system that is said to be simpler, more economical, and as effective as tape or punch cards.

Spindle speeds and feeds in all directions for the entire cycle are predetermined by positioning keys on the control panel. This camless system also provides semi-automatic setting that can be changed instantly to fully automatic cycle, for handling even small production runs.

The hexagon turret slide provides rapid approach and return. Two automatic cross slides are synchronized with and driven by the hexagon turret travel. A square turret slide for semi-automatic operation has seven feeds.

There are eight spindle speeds, all of which can be selected in advance, ranging from 50 to 3000 rpm. Bar capacity is 2½ in. with 18 in. swing over the bedways. Bar feed and collet clamping are automatic. A stop device is provided to preset lengths up to 9½ in.

Distributed by S & S Machinery Co, 146 53rd St, Brooklyn 32, NY

MORE DATA? Circle 140, inside back cover

Straightener and Cutter Processes Wire From 5/32 to ⅜ in. in Dia

Shuster 2ABV is an infinitely variable speed automatic unit added to Mettler line.

Features include straightening arbor, high-speed type, with five elongated split dies, mounted on ball bearings; Reeves variable speed units that provide a choice of feed ranges from 50 to 200 fpm; electric brake on clutch shaft; feed roll housing and gear-driven 5-roll preliminary straightener totally enclosed with shafts mounted on Timken bearings; angled, electric control panel for one-position operation; long-life limit switch trips new improved target.

Mettler Machine Tool, Inc, New Haven, Conn

MORE DATA? Circle 141, inside back cover

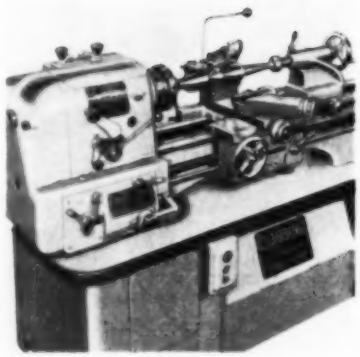
Starrett Announces Disc And Blade Micrometers

Designed to measure the thickness of closely spaced sections, the disc type micrometer (above) can be used where clearances are as limited as 0.015 in. No. 256 Series disc type micrometers have thin, tapered anvil and spindle discs, ½ in. dia, 1/16 in. thick at the center and only 0.015 in. thick at the outer edges.

Micrometer calipers with blade type anvils and spindles (below) are designed to measure depths of narrow grooves, slot keyways, or recesses, or for measuring diameters between lands, fins, or ridges. The blade type anvil and spindle is only 0.030 in. thick and will measure depths up to 5/16 in. The spindle is non-rotating and will not turn in a slot or roll off a narrow shoulder.

L S Starrett Co, Athol, Mass

MORE DATA? Circle 142, inside back cover



Clausing-Colchester Profiling Lathe To Be Displayed by Atlas

Clausing-Colchester profiling lathes, available in 13, 15, and 17 in. swings, are said to combine the production advantages of automatic duplication with the versatility of a standard geared head lathe. It can reproduce multiple diameters, tapers, 90° shoulders, bevels, radiuses, grooves, chamfers, and undercuts. Front tool post can be used immediately for second operation work such as cutoff.

Profiler tool slide and hydraulically operated angle slide are mounted on rear of carriage cross slide, with hydraulic slide 60° to axis of lathe bed. Lathe features include big work capacities with large spindles, tapered roller bearings with oil flow lubrication, tapered key drive spindle nose, enclosed geared headstock and quick-change box.

Clausing Div, Atlas Press Co, 21-101 N Pitcher, Kalamazoo, Mich

MORE DATA? Circle 143, inside back cover

Stokes Offers Equipment for Sintering and Heat-Treating

Sintering, heat-treating, or degassing at temperatures up to 2200 C (4000 F) can be carried out in Model 435-582 cold-wall vacuum furnace.

Also demonstrated are Model 437-520 vacuum melting and precision casting furnace for preparation of small quantities (5 to 17 lbs) of high-purity metals and the production of precision-contour parts by investment casting or permanent-mold

casting techniques, and Model 1710 mechanical booster vacuum pump (1100-cfm capacity) for rapid evacuation of large spaces such as high-altitude simulation chambers, and for vacuum processing systems such as baking ovens for the brazing and fusing of semi-conductors.

F J Stokes Corp, 5500 Tabor Rd, Philadelphia 20, Penna

MORE DATA? Circle 144, inside back cover

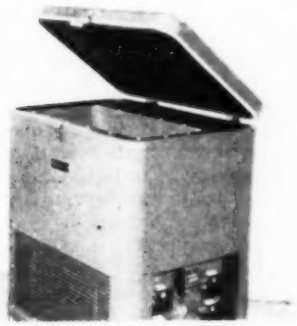
4-ton Straightening Press Offered by Anderson Bros

New HP-004P power-actuated hydraulic straightening press incorporates same basic features as company's 10, 25, and 50-ton power presses.

Also exhibited are the manufacturer's power scraper for scraping flat bearing surfaces; Model HP-010 manually operated hydraulic straightening press; stand-type and pillow-block balancing ways; and a line of hand scrapers.

Anderson Bros Mfg Co, Rockford, Ill

MORE DATA? Circle 145, inside back cover



Metal Part Chilling Machines Designed for Production Use

Model V-120-4 chilling machine (illustrated) has a thermal capacity of 1200 Btu per hour at –120 F and will chill 60 lbs of steel per hour from –70 to –120 F. Temperature range is –70 to –140 F. Chamber measures 30 in. long by 31 in. wide by 44 in. high. Weight is 835 lb.

Model A-120-5, with a chamber measuring 30 x 18 x 16 in., has a temperature range of –70 to –130 F.

Cincinnati Sub Zero Products, 5932 Reading Rd, Cincinnati 29, Ohio

MORE DATA? Circle 146 inside back cover

Norelco to Exhibit Two Spectrometers

Norelco will exhibit a universal vacuum X-ray spectrograph, a portable spectrometer, the Autrometer, and an electron microscope.

Vacuum spectrograph analyzes elements in the atomic range of 12 to 98 and achieves higher intensities in the 17-30 range. It is used with the standard X-ray generator. Although designed for vacuum operation, the unit can be used with air or a light gas filling. Four specimens can be inserted simultaneously.

Portaspec is a portable spectrometer for analytical work in the field and around industrial plants. Elements can be analyzed in a minute or two. With a lithium fluoride crystal, the unit covers the atomic scale from 22-50 in the K series, and from 57-92 in the L series.

The Autrometer, with its universal X-ray detector, automatic crystal changer, and three pre-aligned crystals allows unskilled operators to identify and measure elements at the touch of a button.

The EM-75 electron microscope provides direct magnification of 12,000 diameters on a 4⅝ in. viewing screen, with a resolving power of 35 Angstroms or better. Photo enlargements give magnification above 75,000X.

Philips Electronic, Inc, 750 S Fulton Ave, Mount Vernon, NY

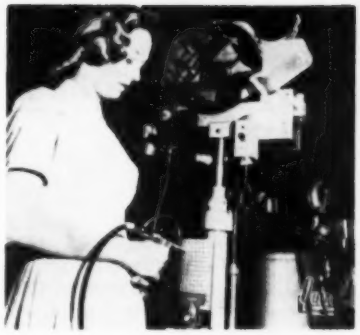
MORE DATA? Circle 147, inside back cover

Collins Microflat Introduces New Inspection Accessories

Accessory line, made of black granite, includes box parallels, precision levels, and parallel, straight edge 90° angle side. New Microloy equipment, 60% lighter than the standard cast iron or semi-steel now in current use, includes angle plates and slotted angle plates; universal right angle irons; straight edged I beam, and bridge-type straight edge; and boring mill parallels. Accessories made of this material are said to maintain a high accuracy.

Collins Microflat Co, 3249 W El Segundo Blvd, Hawthorne, Calif

MORE DATA? Circel 148, inside back cover



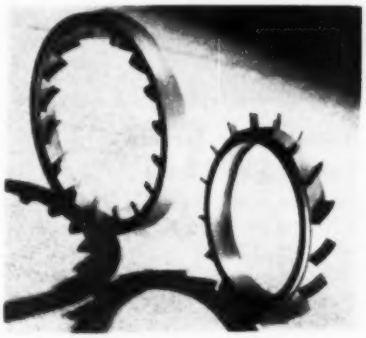
Miniature Automatic Tool Drives Up to 1200 inserts per Hour

Tool for high-speed production installation of wire thread inserts is a hopper feed and lightweight gun combination designed specifically for automated assembly line operation in any type or size of material where higher loading strength and greater resistance to wear are required in tapped holes. The 18-oz gun can be remotely operated up to 8 ft away from the hopper feed mechanism.

Miniature 4-40 Screw-Lock inserts, as well as complete line of larger Screw-Lock inserts will also be on exhibition.

Heli-Coil Corp, Danbury, Conn

MORE DATA? Circle 149, inside back cover



5000-lb Precision Castings Produced by Shaw Process

Castings ranging from a few ounces to 5000 lbs can now be made by the Shaw Process (British), which is a method of precision investment casting without using expendable patterns.

A mixture of refractory aggregate, hydrolized ethyl silicate, and a jelling agent is poured over the pattern in form of a slurry. The pattern may be made of wood, plaster, or metal. The mix sets to form a flexible jell which can easily be stripped. After stripping, the mold is ignited with

1959 Metal Show in Print

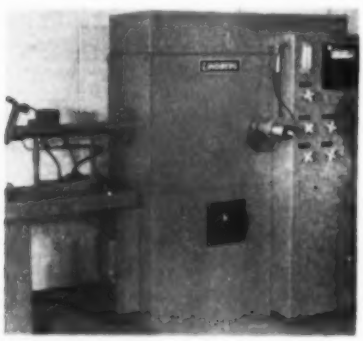
New Metalworking Equipment

a torch to burn off the volatile part of the mixture, assembled and brought to red heat in a furnace. The result is a rigid refactory mold.

Parts up to 3 in. long can be cast with a tolerance of 0.003 in. On larger parts it is possible to hold tolerances of 0.010 in. Castings of 1/6 to ⅛ wall thickness can be produced in steel in weights up to 100 lbs. Surface finishes can be as smooth as 80 to 120 microinches. Pattern to finished casting time is two hours.

Shaw Process Development Corp, 80 Shore Rd, Port Washington, NY

MORE DATA? Circle 150, inside back cover



Graphite Tube Furnace Provides 5000 F Temp

Graphite tube furnace type TR25-212C18 is designed for high temperature metallurgical and ceramic investigation. It uses a tubular graphite resistance element 2 in. ID by 35½ in. long with a 12 in. work zone having a uniformity of ±25 F.

Unit consists of the furnace shell with graphite components, 25 kva transformer, and saturable core reactor; control panel with automatic controller pyrometer, magnetic amplifier, radiation pyrometer, and sight tube; atmosphere flowmeter; control valves and piping for water, atmosphere and curtain burners; disconnect switch; water drain; purge chamber; water jacketed cooling chamber. The entry and exit doors of the tube assembly are protected by doors with flame curtains.

Lindberg Engineering Co, 2450 W Hubbard St, Chicago 12, Ill

MORE DATA? Circle 449, inside back cover

Two New Tensile Testing Machines Process Wide Range of Specimens

Both of these machines, one bench-mounted (illustrated), the other portable, have several accessory sizes and styles of specimen-holding jaws so that they can handle a wide range of flat and cylindrical specimens. Maximum capacities of these models range from 1000-40,000 lbs.

Also displayed are a dial-indicator and optical-type proving rings for measuring loads with high accuracy; a ductility tester; and various types of Brinell hardness testing machines.

Steel City Testing Machines, Inc, 8817 Lyndon Ave, Detroit 38, Mich

MORE DATA? Circle 450, inside back cover

Raymond Lift Trucks Include 2-Ton, 4-Directional Models

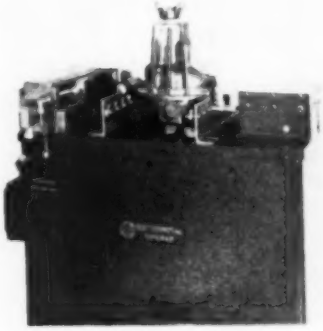
New lift trucks introduced by Raymond are a two-ton capacity heavy duty truck and a truck which can move in any one of four directions.

Features of the two-ton truck (illustrated) include 24-v power, twin traction motor coupled wheels, oversize lift motor for fast elevating speed, and easy accessibility for maintenance. The show model will feature a reach-fork attachment.

The four-directional truck, with wheels hydraulically positioned for forward or side movements, is designed to carry long loads down a wide center aisle, then travel sideways into a narrow aisle. It can handle such materials as bar stock, pipe, or fabricated assemblies.

Raymond Corp, Greene, NY

MORE DATA? Circle 451, inside back cover



High Speed Marking Machines Feature Automatic Operation

Model 465 in-line marking station (illustrated) is conveyor fed and discharged. A wide range of round parts can be adapted to mass production marking when special fixtures are used, according to the manufacturer.

A hydraulic shuttle positions the parts into retractable cradle nests, where parts are marked by a hydraulically operated die slide. Unit is powered by a 2-hp motor.

Model 10T Pneumark impact bench press marks steel parts or nameplates and discharges them into a tote box. Production rate is 3000 to 3600 pieces per hour. Character sizes range from 1/16 to ¼ in.; die space maximum is 11 in. Full 10 ton stamping capacity is available on air line range of 20 to 100 lbs.

Geo T Schmidt, Inc, 4100 Ravenswood Ave, Chicago 13, Ill

MORE DATA? Circle 452, inside back cover

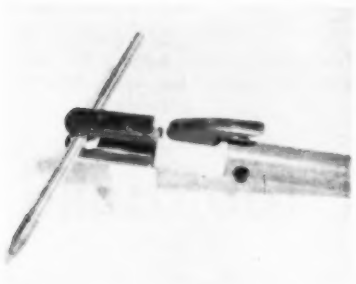
Power-Convection System Uses 200-mph Air for Heat Treating

Power-Convection heat-treating system uses air flow velocities up to 200 mph to achieve unprecedented rates of heat transfer, according to the manufacturer. Cooling as well as heating is speeded up and the uniformity of heat treatment in controlled atmospheres is improved.

Furnaces built with Power-Convection are not limited by the ability to produce and distribute heat, but by the physical abilities of the workpieces to absorb it. Furnace equipment can be designed with much greater production per unit of space.

Surface Combustion Corp, Toledo 1, Ohio

MORE DATA? Circle 453, inside back cover



Seven New Welding Products To Be Exhibited by Arcair

The H-5 metal removal torch (illustrated), equipped with a push-button air control valve in the handle, is designed for use in foundries, plate shops, and shops doing heavy maintenance work. Up to $\frac{5}{8}$ in. dia electrodes can be used. Features include molded heat-resistant jaw insulators, molded plastic upper arm lever, heavier silicone sleeve, and silicone shield on the torch head.

Arc Time Recorder records to tenths of a minute the amount of time involved on Arcair operations for calculating incentive rates.

Model H-55 is a heavy duty model torch for industries whose work requires air on both sides of the electrode. It has a push-button air control valve in the handle and uses either $\frac{1}{2}$ or $\frac{5}{8}$ in. electrodes.

Model Q-3 automatic arcair torch, for joint preparation, consists of a head with an electrode feed mechanism which feeds consumable copper coated carbon-graphite electrodes and supplies a jet of air. It uses 3/16 to $\frac{3}{8}$ in. electrodes and is mounted on a tractor with a speed of 0-180 ipm.

The Air Mover, cylindrical in design, is powered by compressed air from the shop line, and uses a modified venturi principle to remove smoke, fumes, and hot air from welding areas.

Protex is a surface protection compound that will not blow away when used with the Arcair process.

Arcair Weld Help Kit is a sample package of welding carbon plate, rod, and paste.

Arcair Co, Box 431, Lancaster, Ohio

MORE DATA? Circle 454, inside back cover

New Microhardness Tester Offered By Wilson Mechanical Instrument

Model LL is a semi-automatic unit with range of indentation loads from 25 to 1000 g. Instrument is designed for testing of cutting tool carbide tips, drill rods, instrument pivots, plated surfaces, watch springs, surgical needles, and similar items.

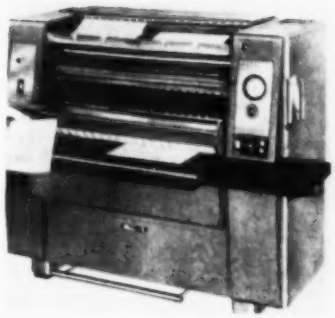
Also displayed are the company's TwinTester, a combination unit which is capable of taking readings in both Rockwell and Rockwell Superficial scales; motorized and semi-automatic Rockwell testers; several hand-operated Rockwell units.

Wilson Mechanical Instrument Division, American Chain & Cable Co, Bridgeport, Conn

MORE DATA? Circle 455, inside back cover

SOLDERFORMS (preformed solder and flux combinations) for application in automated assembly of various electronic products, are particularly suited to the semi-conductor field for use in transistors and germanium diodes — *Kester Solder Co, 4201 Wrightwood Ave, Chicago 39, Ill*

MORE DATA? Circle 456, inside back cover



Diazotype Copying Machine Increases Print Production

Bruning Copyflex Model 675 is a diazotype copying machine designed to reduce operator fatigue and increase production of black-on-white prints.

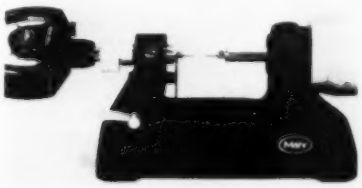
Two operators, each running different types of sensitized materials, can use the machine simultaneously. To eliminate reaching for the print trays, electric jacks raise or lower the Copyflex from 64 to 68 in., varying the feedboard height from 35 to 39 in.

The unit has a 46 in. printing opening which takes sheets and roll stock up to 42 in. wide. Mechanical speed is 75 linear fpm.

A split shade on the fast printing 7500-w lamp (variable to 5000 w) provides the correct amount of light for each print, eliminating the need to run each tracing a separate speed. Vacuum air ports in and below the feed board hold sheets in place.

Charles Bruning Co, Inc, Mount Prospect, Ill

MORE DATA? Circle 457, inside back cover

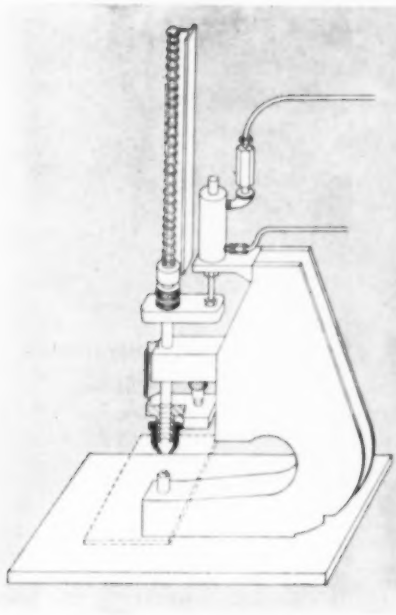


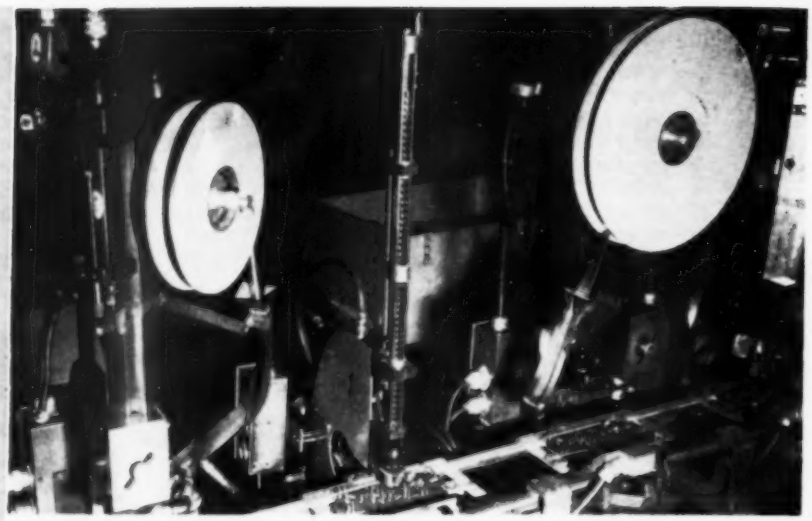
0-1-in. Comparator-Micrometer Reads Directly to 20 Millionths

Super-Comparator bench micrometer, with non-rotating spindle, has a 0-1-in. range and an indicator reading directly in 20 millionths.

Micrometer has a thimble diameter of $1\frac{3}{4}$ in. and throat depth of 1.280 in. With 250 graduations around the micrometer thimble, tenths can be read directly. Instrument measures

(Section continued on p 219)





Tube-socket head . . .
is being developed jointly by Philco and Sylvania Electric to insert sockets into PW boards. This will be mounted on United Shoe machine to increase the number of parts being machine assembled

Simple machines, too, build

Electronic assembly has been mechanized—even automated—and some lines produce well. But "idiot" machines that have only a single, simple purpose often do better because there's less to go wrong. Here is how Philco gets consistent production from one complicated setup, several simple machines, and some that look complicated but aren't

By E W Plesser, manager, facilities engineering, Philco Corp, Philadelphia

Production of all television receivers at Philco has been concentrated in one building instead of two that used to be necessary. This is a direct result of printed circuitry and the mechanization it allows all through the assembly lines. One exception to this one-plant operation, however, is the facility that produces the circuit boards themselves. It is an integrated and mechanized acid-etching and ink-removing line set up to produce all circuit boards needed. It includes continuous acid and water spraying, liquid recirculation and filtration, and controlled warm-air ducts for drying the boards. This has been left in its original location because of its size and complexity.

The PW boards (short for printed wiring, although these boards are etched, not printed) are plastic laminates with a 0.00135-in.-thick layer of pure copper on one side. First operation is to silk-screen the circuit pattern onto the copper side with an acid-resisting ink. The boards (in panels of 4 or 8, depending on individual board size) are racked on a continuous conveyor, then transported through ink drying, acid spray, water rinse, drying (forced air), resist removal, water rinse, and another air dry. Copper not masked by the ink is removed, leaving the desired pattern of wide connecting lines, ground areas, and terminal sections in copper, from which the ink is washed. Ferric chloride removes excess copper, and is handled in a closed system that demands a small amount of makeup solution each day, plus discharge of waste to a diluting tank. First-stage water for rinsing is also in a closed system that reuses water as much as possible. Fresh water does all final rinsing.

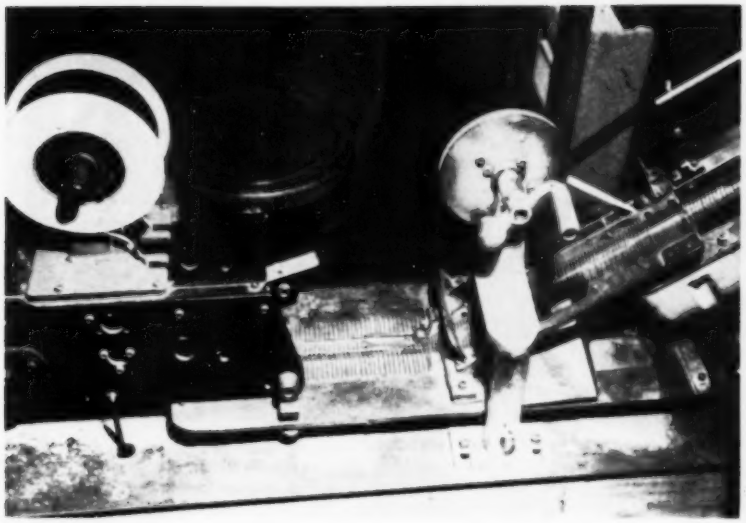
When the boards are dried, they are automatically dropped into bins at a discharge station that trips the conveyor hangers to release each panel in turn.

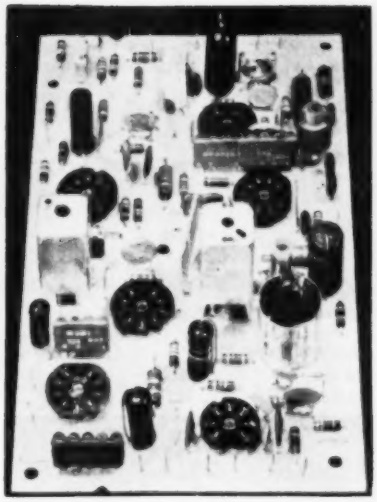
A second silk-screen operation coats a thin film of phenolic resin over the exposed copper to protect it mechanically, to provide extra insulation over the circuit, and to prevent moisture from getting between the copper conductors. Silk screening leaves exposed all sections where leads and wires must go through the board to be soldered later, plus sufficient copper areas around each hole to allow good solder flow for a solid mechanical and electrical joint. This coating is finally oven-cured.

Boards are moved over to a preheat-oven conveyor that is timed to deliver the panels to a press where they are hot-punched. Holes for connectors and wire leads are punched, and the individual boards are trimmed from each other.

The punched boards are then automatically loaded on a conveyor, which takes them through a degreasing station and to a copper-cleaning station. The boards are again rinsed and dried. Then a thin film of flux is roller-coated on the copper side of the board to assist in soldering and to protect the boards in storage for as long as three months.

At the end of this line, the boards are ready to have small components inserted on the side opposite the copper layer. Wire leads from these parts will project through holes punched in the boards, allowing the dip operation to connect them to the etched circuit lines permanently created in copper.





Retaping job . . .
is necessary to put tape on wire leads of small resistors, replacing the body tape that is stripped off. Lead tape prevents swinging; makes leads feed easily to cutting and crimping tools

TV sets

Automatic assembly

Simple inserting heads provide highest reliability for automatic component assembly to PW boards. Although the United Shoe Machinery Corp insertion line looks complicated, it is composed of several simple elements. Many machine heads insert ½-watt resistors, and these heads are identical. Only their positions need be changed to locate the resistors at the proper punched holes through the PW boards.

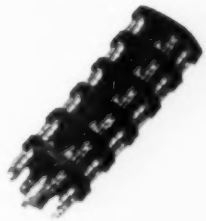
Resistors inserted by these heads are held together in the machine by taping the ends of the leads to form a sort of chain. Leads are inserted through holes in the boards by the machines, and are then staked by simple anvils appropriately shaped to form the lead under each board.

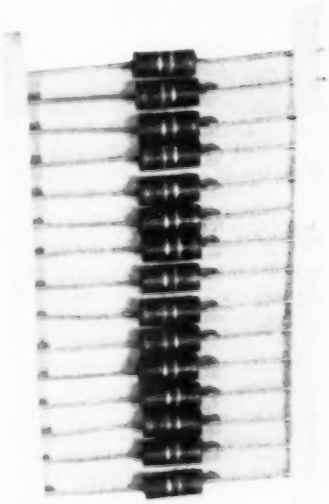
Another type of head inserts larger resistors and tubular capacitors. These heads feed body-taped components from reels, strip the tape from the body, grip the component, cut the lead to length, form the lead, and insert the component with the leads through appropriate holes in the board. After the leads are in position the head maintains its grip, and a pair of mechanically operated anvils automatically wipe the leads to form crimps designed to retain the part in the board. This also positions the leads for dip soldering.

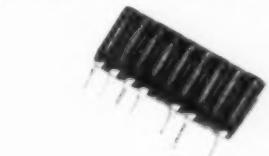
Jumper wires are inserted by a slightly different style of head that feeds the wire to a predetermined length, cuts the wire, and bends down the ends.

Newly added heads now insert tube sockets from a magazine feeder; but other operations are the same—a staking head peens the center terminal (designed with cutouts for easy collapse) after all pin terminals are through the board in their proper holes.

Up to 72 components can be machine-inserted automatically along the indexing conveyor. Interlocks and limit switches control all motions. Maximum capacity of the line is 1440 boards/hr. This quantity is sufficiently high that boards for one

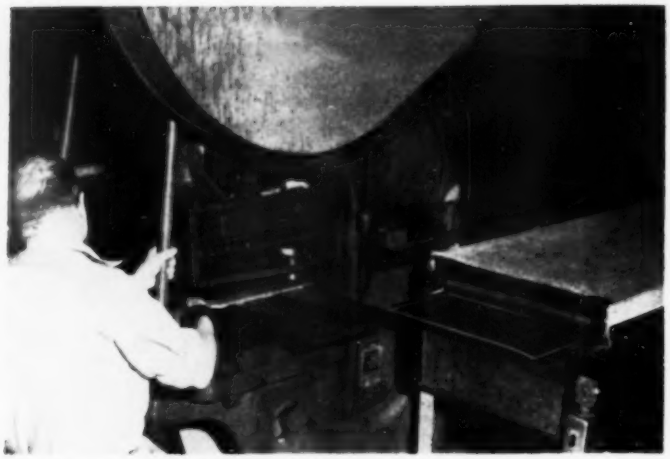




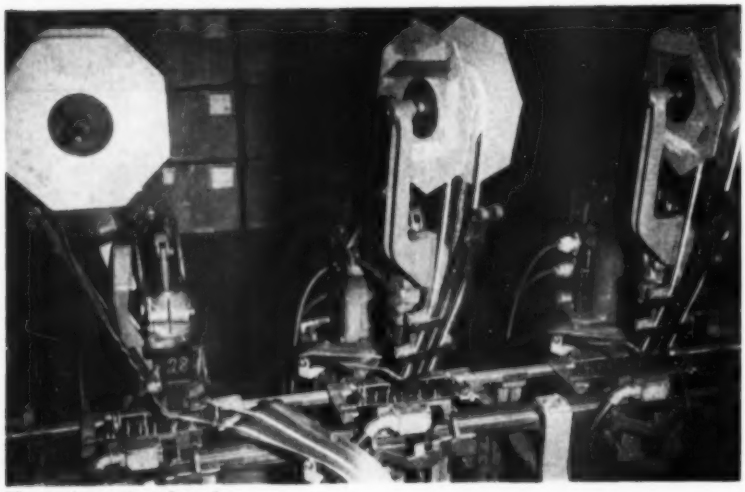


Printed-circuit parts . . .
must be certain shapes and sizes for automatic assembly. Taped resistors, tubular capacitors, and nested sockets can be machine-fed; others are not uniform enough or easily enough gripped by machines. Hand assembly is required for IF cans, tube shields, and coils used in conjunction with printed circuits

Circuit pattern is printed . . .
on copper-clad phenolic sheet by silk-screen process at a semi-automatic setup. This puts acid-resisting ink over copper areas that are to remain. Sheets are passed on to etching station



Panels are punched . . .
at a conventional press to produce holes that clear wire leads and pins, and to separate 8 PW boards from the large panel. Preheat at right brings plastic to non-chipping condition



Three insertion heads . . .
locate ½-watt resistors in PW boards. Resistors are lead-taped to improve feeding reliability. Boards are fed by walking-beam conveyor at this United Shoe "Dynasert"

TV model can be run, then stored while another model is being run. Changeover from one board model to another requires head repositioning, loading reels of parts with different values in the heads, and turning on or off different heads as required.

Because the heads are fairly simple and similar, trouble with one head can be quickly overcome by replacing it. Minor breakdowns or head misalignments can be adjusted quickly. Major breakdowns, now that the machine has been operating for several years, are few.

In spite of mechanization, PW boards, and automated component insertion, there is still a considerable amount of hand work necessary for a television receiver. Not all parts for a PW board can be machine inserted. On one line, Philco has operators who trim part leads to length and insert them by hand, crimping the leads with power tools.

Although an up-to-date TV set includes about three quarters of the entire complex circuit on the panel boards, there is much additional wiring for larger components—high-voltage sections, transformers, tuners, and control panels. This means that jumper wires must be installed from the PW board to the other sections. Most efficient jumper-wire method to date is with solderless wraps, the wire-wrapping system developed by Bell Telephone, which are handled with an air-powered portable tool. Long spade terminals are automatically inserted by machine in the PW boards for wire ends, and similar terminals are located on other parts. Operators jump from one terminal to its mate with prestripped wires, wrapping at each terminal.

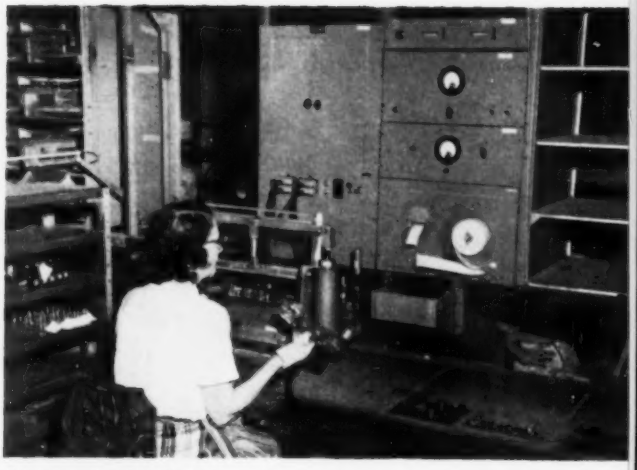
Now being tested and about to go into full production is a new assembly line developed so operators can insert two parts (one with each hand) into PW boards at a time. Some of the tinned leads must be precut for this operation, but on other parts special cutters do this job. The heading cylinders are powered.

This line will feed a new automated solder-dip station where a walking-beam conveyor that serves the assembly line will also bring PW boards over a raised, pressure-fed manifold at the solder pot. At older semi-automatic dipping stations, each solder pot has to be skimmed by a sweep arm connected to a safety gate—to wipe oxides and dirt from the surface of the molten solder. At the new station, the solder will overflow continuously so it remains clean all the time. The whole solder pot is raised by a motor and cam to bring solder up to touch the bottom of the PW panel. Solder contacts the panel for only about 1 sec, so the phenolic is unaffected by heat.

Automatic test

All finished PW boards are tested by a single-purpose electronic computer that can check up to 99 circuits at once. Mechanical contacts are brought down like a press ram to touch contact points on the inverted PW board, which is manually loaded into the opening of the machine. This is a continuity test, and

Hand assembly . . .
is still the only way for irregular or delicate parts. Operator can insert a part with each hand, trip anvils that crimp the leads under the panel. Walking-beam conveyor moves PW boards



Automatic circuit test . . .
checks up to 99 individual circuits and components in 12 seconds, and delivers a ticket (under meters at right) that identifies any wrong values or connections, or prints a coded "OK"

it produces a printed paper ticket with numbers that indicate all circuits and components are correct, or if one or more are faulty it indicates which circuits are in trouble by identification number (such as 012). A following station checks and repairs any breaks in soldered joints or replaces faulty components.

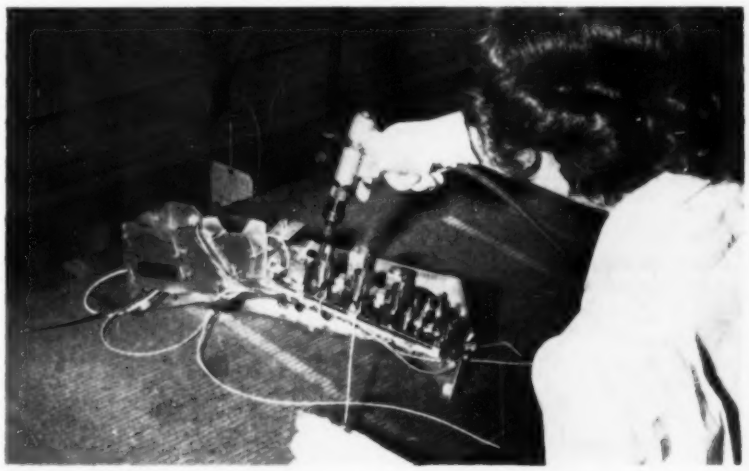
Why Some Parts Won't Assemble Automatically

The most important single rule for mechanized assembly is this: Once you grip the part, don't let go until it is permanently fastened in its final location. Dropped or out-of-control parts are difficult to handle by machine, and they often jam feeding and assembly equipment.

It is always difficult to improve on hand assembly, even if great economies are possible. No mechanical device can match the dexterity of the human hand, and no programmed mechanical feeder can provide the judgment, skill, and adaptability of a human assembler.

The simplest parts are tough enough. Small ½-watt resistors, for example, are the most widely used elements in electronic gear. They are 5/32 in. in dia, ⅜ in. long (within a tolerance of roughly 1/32 in.), and have axial tinned-copper leads about 3 in. long. Suppliers furnish them presently in body-taped reels. A simple retaping operation to lead tape is necessary to arrive at high feeding efficiency required—in the order of 99.95%.

This is done most effectively in a simple machine designed for a single part size and design—but there is enough work to keep the machine busy full time, so retaping cost is not excessive. The machine retapes a reel of 2500 resistors in about 5 min.



Wire-wrapping . . .
joins jumper wires between PW-board terminals and mating terminals on other panels or parts located elsewhere in the TV receiver. Experience has shown that wrapped connections last as well as soldered joints—and they're faster and easier to make

Larger resistors and tubular capacitors—round bodies and axial leads—are handled the same way, except that body tape is usually enough to keep them in line at the insertion machine.

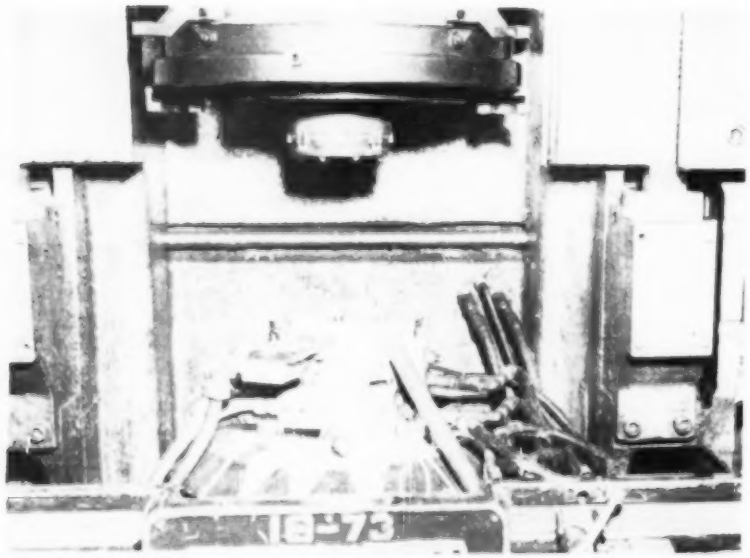
But other parts used in large quantities are much more difficult. Flat, round, disk capacitors, which are standard because of small size and low cost, are tough because of their mechanical configuration.

Some progress has been made with coils recently—peaking coils for the TV chassis are made by inserting the winding into a rectangular form equipped with leads projecting from the edges. These are not yet machine-fed, but prototype equipment is now being designed. New tube sockets have been recently adapted to feed down a magazine to an insertion head. These are special sockets that nest together; they are separated by the insertion head and driven into PW boards. Special configurations on the pins allow them to snap in and hold securely until soldered.

Transformer cans, round coils, and special printed-circuit subassemblies have not yet been mechanized. As is the case in any kind of assembly, technical factors fight with economic factors; and the industry has not yet standardized completely on physical specifications to make all parts both inexpensive and capable of being inserted mechanically.

Lugs, splines, teeth . . .
Auto-transmission parts are finish-shaped by Shear-Speed process, which affected part-design requirements

Chrysler shears designed-

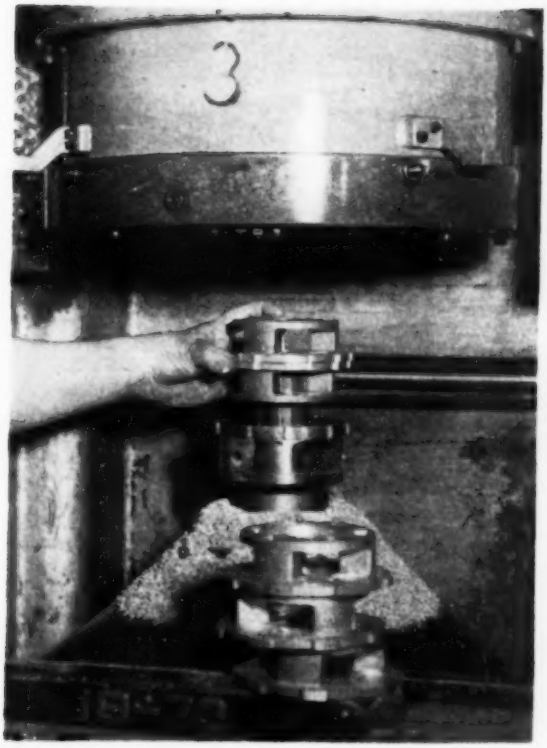


Housing is slotted . . .
Aluminum output-shaft drive housing is slotted internally by eight cutter bits. Part locates in fixture on hub-rim face. Air clamp grips the part

By George H DeGroat,
Detroit editor

Transmission parts are produced at Chrysler's Kokomo, Ind, plant at low cost and to an improved design because the entire power train was planned around a specific method of making irregularly shaped spline and gear teeth. Michigan Tool Co's Shear-Speed process was found by Chrysler engineers to be adaptable to clutch plates with fewer teeth on the OD. Fewer teeth reduce friction and reduce the possibility of binding to a bare minimum. They also improve operating characteristics.

This approach to design, with the fabricating department controlling to some extent the design of the product, is a reversal of the usual practice. But in this case cooperation between designers and production engineers on a new component or assembly long before it leaves the drawing board is the technique



Two at a time . . .
Eight equally spaced lugs around CI planet pinion carriers are shaped with parts mounted face-to-face, piloted on their ID's

Stack of eight . . .
Automatic load and unload fixture places parts on the centering arbor, where three fingers center the parts for lug shaping

for-production gears

that works—at least it works for Chrysler.

Gears and other parts are produced in steel, aluminum, and cast iron on the Shear-Speed machines, which have high output that allows production balancing for various components in the power train. Fixtures, machine strokes per minute, and other elements of cycle time were selected to suit the overall production rate. One example: Where multiples of a particular part are needed for assembly, two to eight parts can be stacked for simultaneous cutting.

Space efficiency

High production is possible from a relatively small floor space. The machines are usually arranged in groups of three—two working, one in reserve for tool change—all handled by one operator. Good results are obtained with HSS form tools.

Splines are rolled on input and output shafts by Michigan "Roto-Flo" machines, but lugs on the input-shaft faceplates are cut in the Shear-Speeds. Other toothed power-train components—there are nearly a dozen altogether—include the front-clutch driving-disk hub, the front retainer-clutch piston, output-shaft drive housing, overrunning-clutch hub, carrier planet pinion, low- and reverse-band drum, clutch pressure plates, reverse annulus gear, and the rear-clutch piston retainer.

Close machining

A typical Shear-Speed operation is shaping 45 external splines on the CI driving-disk hub. The teeth have a 30° pressure angle, DP of 11.4894, and a base-circle diameter of 3.3919. A PD of 3.9167 in. must be concentric with the 1.0833-in. PD of an internal spline through the bore of the hub within 0.004-in. tir. Maximum accumulative pitch error is 0.0015 in., maximum involute profile error is 0.0005 in., and maximum lead error is 0.0003 in.

Four parts from a gravity chute are manually loaded into a work-holding fixture on a model 1873 Shear-Speed, locating on the minor diameter of the internal splines. The first part is loaded face down to provide a clamping surface, and the others are face up. When a cycle button is depressed, the cutter head starts down into cutting position carrying an air clamp that contacts the top part to lock the stack against a shoulder in the fixture. The cutting cycle starts as the ram starts reciprocating vertically while the tools feed radially into the work. Upon finishing the cut, the tools retract, the air clamp is released, and the head raises to clear the work. The four parts are then unloaded manually and replaced by four others.

This technique is typical of other Shear-Speed operations where several parts are finish-shaped at once.

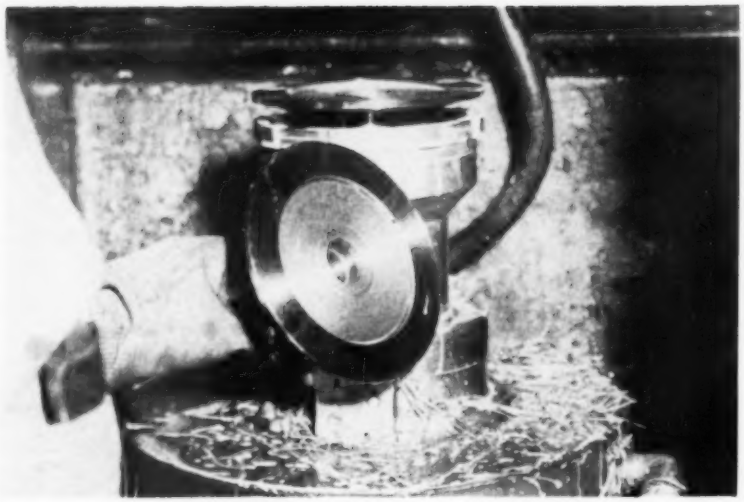
Chrysler gears . . .

although there are variations depending upon part size, geometry, and the specific operation to be performed.

For example, two overrunning clutch hubs are machined together at a three-machine setup where one operator places a pair of parts in a hopper with the flanges to be cut facing each other. Loading the Shear-Speeds is automatic, and each ¼-in.-thick flange receives eight equally spaced lugs ⅝-in. wide. Tool life in cutting these steel hubs (60 Rc minimum) is approximately 1200 pieces per cutter grind.

Other parts

A trickier part that gets similar lugs is the steel reverse annulus gear. Two Model 1872 Shear-Speeds are used for this work, where care must be taken in setting up the job to avoid overtravel of the tools because there is only a small amount of clearance between the end of the lug and a shoulder beyond it. An operator manually loads these parts one at a time into a fixture with a ⅝-in.-thick flange into which the lugs are to be cut facing upward—locating on the ID. Tool life is about 1100 pieces per grind.



Shaft flanges are shaped . . .
OD's are cut concentric with the bearing diameters within 0.002-in. tir. Parts are manually loaded on a spring center

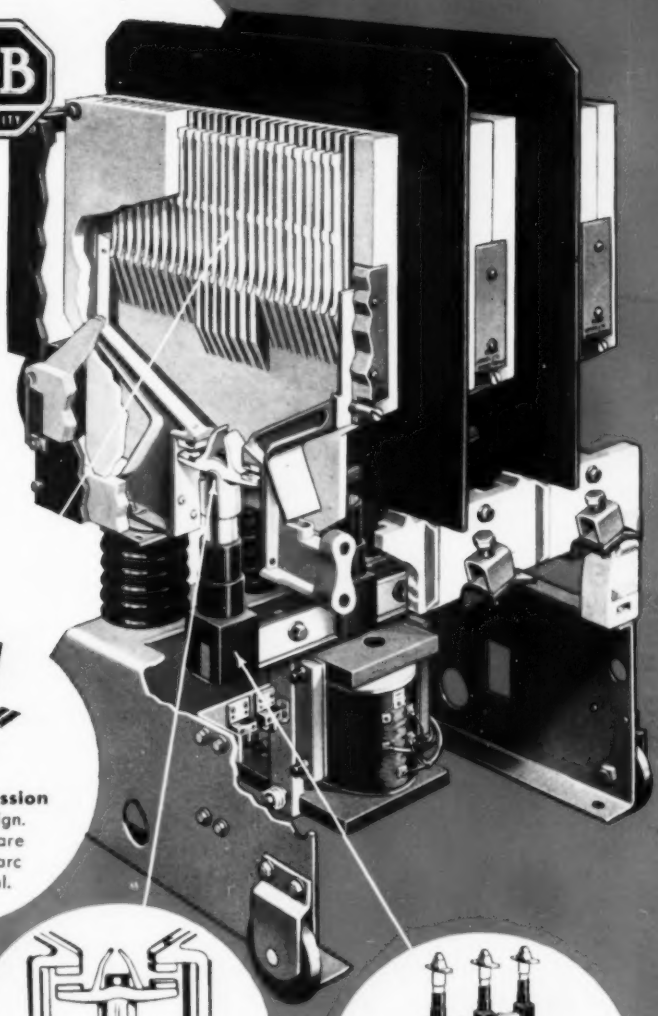
By using a battery of the same machines for performing similar operations on the various components of this assembly, production engineers can anticipate related tooling and setup needs as well as such other requirements as scheduling and maintenance. The use of a single process for a variety of parts also reduces tool costs by eliminating large cutter inventories and by simplifying tool sharpening.

Gage detects plating thickness in millionths

So sensitive it can indicate differences of one-millionth, the Mag-ray gage has been developed by Boeing Aircraft Company, Seattle. Gage is a two-in-one unit that incorporates electrical and radiation principles. One portion measures ferromagnetic platings; when a spring attached to a magnet is placed close to the plating, deflection of spring is measured by a capacitance meter that is calibrated to indicate thickness. Second portion gages other platings by use of beta rays emitted from Carbon 14; rays are directed onto specimen, then amount of ray backscatter, reflected into a counter, is measured for indication of thickness. In photo an engineer holds rhodium-plated disk in right hand, adjusts backscatter instrument with his left

Here's the inside story of industry's

MOST RUGGED HIGH VOLTAGE SWITCH



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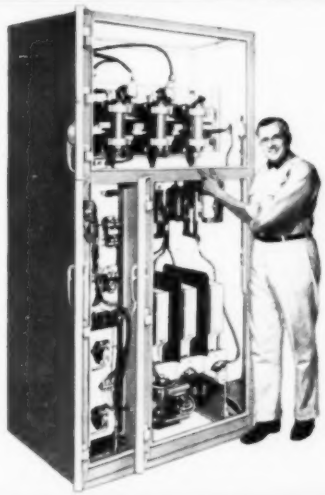

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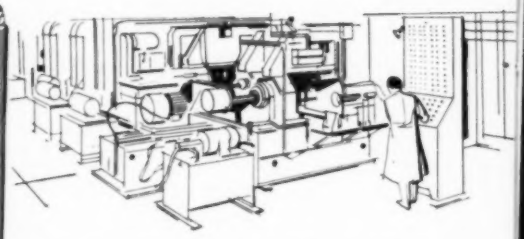
AUTOMATION BEGINS HERE

. . . Insist on Allen-Bradley accessories for continuous automatic production



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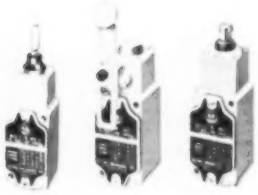

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Bulletin 802T with sealed heads and bodies. Various operators.

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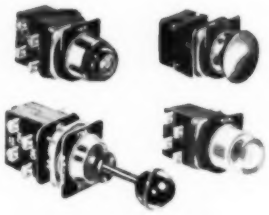
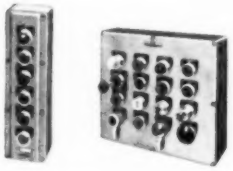
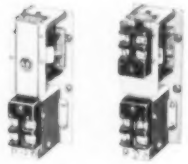


OILTIGHT CONTROL UNITS
Bulletin 800T. Choice of push buttons, lights, and switches.



OILTIGHT CONTROL STATIONS
Bulletin 800T for up to 16 units in die cast aluminum enclosure.



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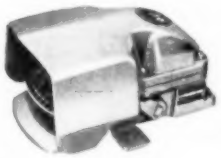

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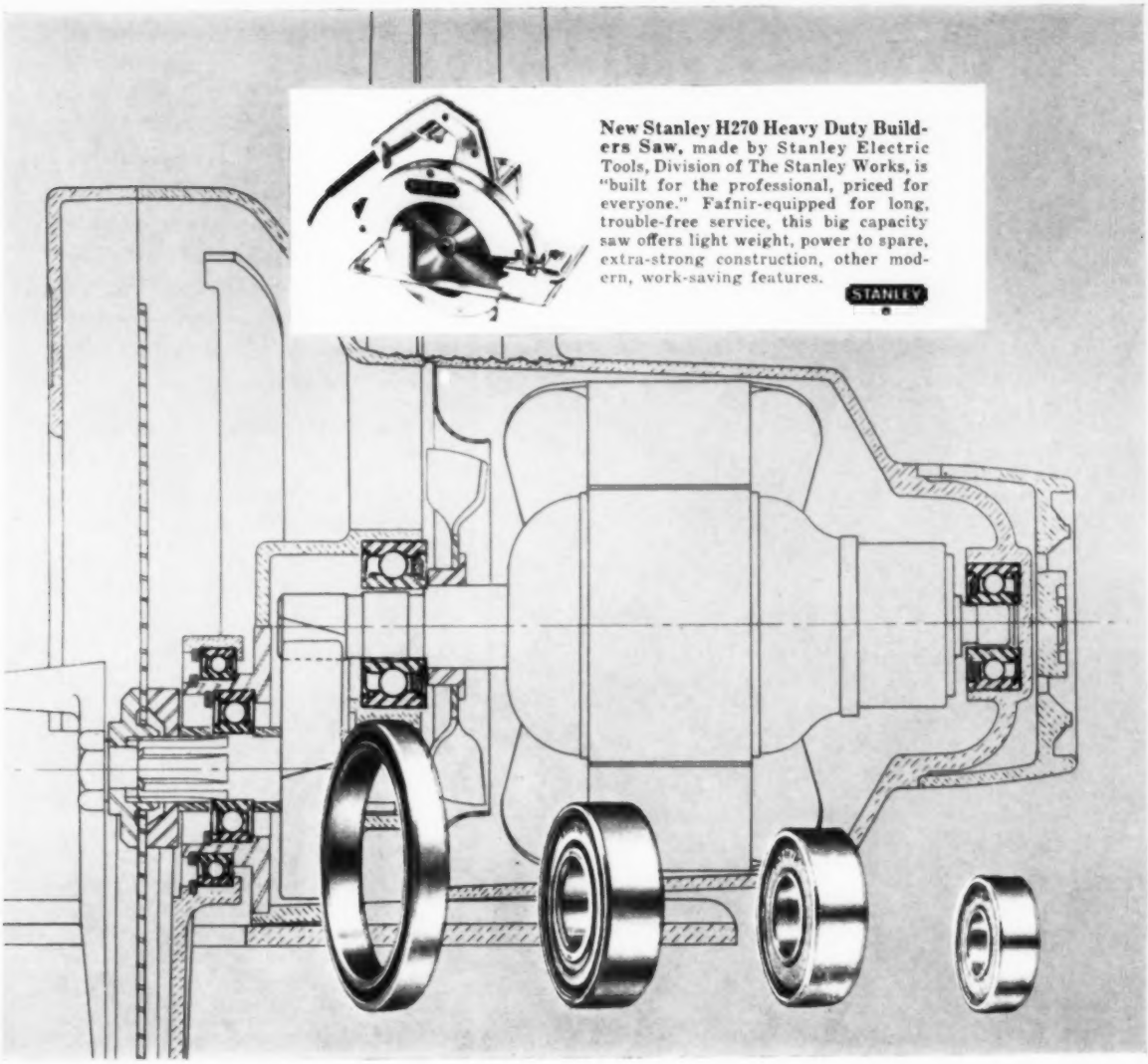

New Stanley H270 Heavy Duty Builders Saw, made by Stanley Electric Tools, Division of The Stanley Works, is "built for the professional, priced for everyone." Fafnir-equipped for long, trouble-free service, this big capacity saw offers light weight, power to spare, extra-strong construction, other modern, work-saving features.

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Armature, saw shaft, even the blade guard Fafnir-mounted for free-starting, no-maintenance, heavy-duty performance

Nearly 40% more cutting force at working speeds, with 27% less operator effort! This new Stanley power saw represents a design achievement of the first order. And to insure long, efficient service life, Stanley makes generous use of Fafnir precision ball bearings. Even the blade guard is Fafnir-equipped (with an aircraft type bearing), for responsive action at the slightest pressure. On the armature and saw shaft, Fafnir ball bearings all but eliminate friction and wear. Bearing maintenance is eliminated, too. Various combinations of seals and shields lock out contaminants, lock in factory-packed lubricant. No danger of faulty or neglected lubrication... virtually no chance of bearing failure.

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Machining Beryllium—I

Source: Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio

Beryllium machines like cast iron, but is more abrasive to tools. Its brittle behavior can cause spalling at the exit of cuts and cracking at the surface. During machining, pieces of built-up edge slough off the tool, causing a scuffed, machined appearance. Carbide tools are normally used for turning, milling, and drilling at speeds up to 250, 150, and 100 sfpm, respectively.

The Atomic Energy Commission recommends that "for the present it is safest to regard beryllium metal and all its compounds as potentially toxic." Beryllium should be machined in an easy-to-clean, isolated area. The AEC recommendation for a safe beryllium-in-air concentration is 2.0 micrograms or less per cubic meter.

Turning

In lathe operations the cutting speed must not exceed the capacity of the exhaust system and method of collecting chips. Consequently, lower speeds are usually necessary for clean chip salvage and efficient dust disposal.

Threading is done with a single-point tool, because dies or chasers are not usually recommended. Beryllium may spall in small pieces which crowd into the tool. This can cause torn threads and excessive tool wear.

The tendency to spall when the tool leaves the cut can be overcome by chamfering both ends of the work to the finished diameter before turning. An alternative method is to finish turn one end for a short distance, reverse the ends and then finish turn the remainder. In both cases, light cuts (i.e., less than 0.015 in. deep) should be taken. Live centers should be used, because beryllium is highly abrasive to all tooling.

Tool Materials—Carbide tools are used for machining beryllium. Tool life is comparable to that obtained when machining carbon steel. The wear land on the clearance face of the tool grows uniformly, and the wear on the cutting face (cratering) is not severe.

Carbide tools should be resharpened as soon as they become slightly dull. Tooling costs and resharpening costs are always high for the machining of beryllium.

Use carbide Grade C-1 for interrupted cutting; Grade C-2 for continuous cutting.

Tool Design—A large side-cutting-edge angle is usually ground on the cutting tool to ensure that the impact load will be taken at a point back of the nose. It will also ease the tool out of the cut at the end of the piece. Excessive angles, however, will lead to chatter.

The end-cutting-edge angle should be large enough to allow the tool to clear the work.

The nose radius should be small (1/64 to 1/32 in.). It should be omitted on heavy cuts.

Feed and Depth of Cut—Feeds should not be over 0.015 ipr to prevent rough finishes and "breakouts" on edges. Extremely fine feeds also should be avoided. They tend to dull the tools faster and heat the work more than heavier cuts do.

A cut deeper than 1/16 in. can create a safety hazard if the exhaust system is unable to remove the chips efficiently. The part should be critically inspected for possible surface cracks.

Coolant—Usually no coolant is

Table I—Design and Use of Single-Point Tools

Tool Geometry	Turning	Forming
Back rake angle, deg.	0	0
Side rake angle, deg.	7 to 8	None
Side-cutting-edge angle, deg.	12 to 15	None
End-cutting-edge angle, deg.	8 to 15	None
Side-relief angle, deg.	7 to 10	7
End-relief angle, deg.	7 to 10	7
Nose radius, in.:		
Continuous cutting,	1/64 to 1/32	
Interrupted cutting	1/16	None
Speed, Feed, and Depth of Cut		
Speed, fpm	150 to 250	
Feed, ipr	0.01 to 0.015	
Depth of cut, in.	Up to 0.100	
Horsepower	1 hp per cu in. per min.	

(Speeds up to 1000 fpm may be used for very short intervals)

Table II—Design and Use of Milling Cutters

Tool Geometry	Rough and Finish Milling
Back rake angle, deg.	0 to 10
Side-cutting-edge angle, deg.	7
Face-cutting-edge angle, deg.	3 to 7
Side-relief angle, deg.	10 to 15
End-relief angle, deg.	10 to 15
Land, in.	1/32 to 1/16
Speed, Feed, and Depth of Cut:	
	Roughing / **Finishing**
Speed, fpm	60 to 100 / 100 to 150
Table feed, ipm	3 to 6 / 3 to 6
Depth of cut, in.	No data / No data

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Machining Beryllium—II

applied. Turning with a coolant may be practical only when a small amount of material is to be handled. Such an operation, however, can become uneconomical because of the large differential in value between contaminated and uncontaminated chips.

Milling

Conventional milling, rather than climb-milling, is recommended to obtain the best finish with most economical use of cutters.

Because beryllium tends to chip as the cutter leaves the work, some suitable backup material, such as free-cutting steel, should be used. The steel chips then can be readily removed from the beryllium chips by a magnet.

Tool Materials — Use carbide Grade C-1 for rough milling; carbide Grade C-2 for finish milling.

Speeds should be selected on the basis of minimum airborne dust and by the chip-disposal arrangement at the machine. Proper and efficient chip-disposal equipment should operate at all times.

Coolants—Ordinary soluble oils or emulsions may be used, 1 part of oil to 20 to 30 parts of water.

If a large amount of beryllium is to be removed, it may be more profitable to machine dry, provided an adequate exhaust system is present.

Drilling and Reaming

Drilling beryllium is a difficult problem, because the metal tends to seize iron and steel. It may be necessary to change drills several times in a single hole, especially when drilling deep holes.

When holes are drilled through, the material around the hole exit may spall as the drill breaks through. A backup block of beryllium or steel should stop this.

Stock allowances used in machine reaming are:

Hole Diameter, In.	Stock Allowance, In.
1/4	0.01
1/2	0.015
1 1/2	0.025

An allowance of 0.001 to 0.003 in. is common for hand reaming.

The speeds commonly used are two-thirds of the speeds listed under drilling.

Solid carbide or carbide-tipped drills are recommended for major drilling operations. When carbide drills are not available, high-speed steel drills can be used for limited applications.

A 90° included angle is used for both carbide and HSS drills.

Drill Size, In.	Speed, fpm	Feed, ipr
Under 1/8	70 to 100	0.001-0.002
1/4	70 to 100	0.002-0.004
1/2	70 to 100	0.005

For normal drilling, ordinary soluble oils can be used in ratios of one part of oil to 20 to 30 parts of water.

Deep-Hole Drilling

Considerable difficulty may be experienced in drilling hole depths greater than five times the diameter of the hole, using conventional carbide-tipped twist drills. As the heat of cutting accumulates in the drill and in the workpiece, the drill may expand more than the hole, eventually causing the shank to rub against the wall of the hole. When this happens, more heat is produced, and the binding gradually becomes worse until seizure and drill failure occur. If certain modifications are made in drill design and in tool holder design, deep holes can be successfully produced with either a standard drill press or a deep-hole drilling machine. Pieces either too large to rotate in a deep-hole drilling machine, or beyond the range of a drill press, can be drilled on an engine lathe.

Conventional Drills—The standard design is a two-flute, oil hole drill with its point ground to a 90° included angle. The drill shank should be undercut 0.010 in. on the diameter behind the carbide tip. The carbide tip should back taper 0.004 in. per in. The primary clearance angle should be increased to about 6 deg.

Use of special toolholders helps to minimize drill breakage. The drill can be held in a revolving-type socket located in the toolholder. The collar of this socket can be provided with a single cam which rests on a spring-loaded lever attached to the face of the toolholder. The spring is adjusted to a tension sufficient to hold the drill in place against normal machining pressure. If excessive pressure occurs, the cam should trip the spring lever and permit the drill socket to rotate freely in the toolholder.

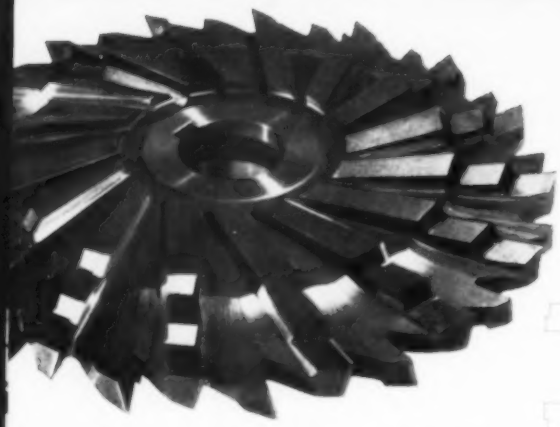
Rifle Drills—A single-flute carbide-tipped rifle drill has a seamless steel tube shank slightly smaller than the tip. One side of the tube or shank is depressed to form a V-groove which extends to the point of the drill. Two 1/32-in. holes are drilled longitudinally through the tip just below each outer corner of the V-groove. These holes provide for the outlet of coolant from the hollow shank into the cutting site. The V-groove provides for the outflow of the chip-laden coolant from the site of cutting. Longitudinal clearance is present along the tool body to reduce friction and to allow coolant flow around the tip and into the V-groove.

The cylindrical tool body immediately behind the cutting tip rests on the finished surface of the hole to guide the point into the work. On 3/16-in. drills, the guiding elements of the tip consist of a cylindrical land 1/64 in. wide located below the cutting edge, and a bearing surface 7/32 in. wide located diametrically opposed to the land.

Speed, Feed, and Depth of Cut—For conventional twist drills in drill presses, deep-hole drilling machines, or engine lathes, these data apply:

Dia, In.	Depth, Ft.	Speed, Fpm	Feed, Ipr
1/8	2-3	70-100	0.004

Coolant—Kerosene should be used at a pressure of 200-psi minimum.



A special multiple-step milling cutter used by steam turbine manufacturer to cut stepped rotor slots for turbine blades.

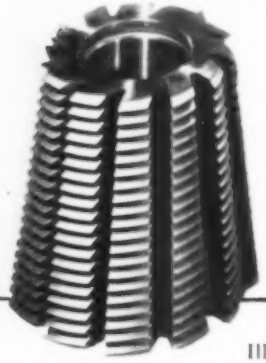
This cutter is used by a prominent saw manufacturer to form mill the profile in dado blade sets for the wood working industry.

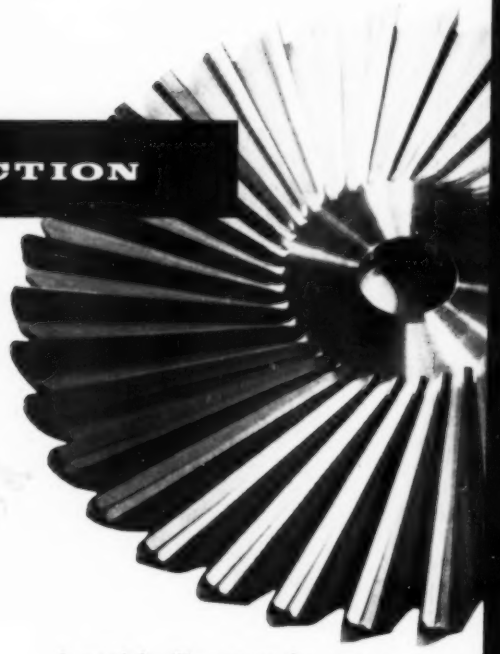
HOW TO GET THE MOST

OUT OF HIGH SPEED PRODUCTION

MILLING MACHINES

This tapered multiple thread mill cuts threads in pipe joints used in oil well drilling operations.





A special milling cutter for sweep milling impellers used in air conditioning and jet engine sections.

Illinite® Special Milling Cutters, like those shown here, speed production and cut costs two ways:

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Measuring Tapers

By Carle Spriesterbach, The Sheffield Corp, Dayton, Ohio

Here is a method that will enable you to measure the small end of taper plugs and the taper simultaneously without the necessity for grinding a roll for each job to be checked.

We developed this method because we knew that our toolmakers each had a number of rolls of known sizes. Our method of checking will permit using these rolls even though they range from one-fourth to three-fourths of the diameter at the small end of the plug. Thus, we are not faced with the considerable expense of grinding a roll that is tangent to the extension of the conical taper, as in Fig. 1 (original method).

With a small amount of practice the roll and plug can be held against the backstop of the sine plate and pushed under the comparator.

The important elements of measurement are: the distance A from top of roll to the plate, the distance of the upper element of the cone above the plate, and the angle α as determined by the sine bar.

Steps in Measurement
(Using standard 5-in. sine bar and 90° backstop)

1. Set up sine bar
2. Choose a roll of known size (somewhere near the size of the plug at the small end).
3. Find the size over the roll—dimension A.
4. Solve for X (see equations below)
5. Calculate constant from equation: Constant = $A - R - X$
6. Find dimension B or cos $\frac{1}{2}\alpha$ times assumed size at small end.
7. Add results of steps 5 and 6 to get checking setup.

Solving for X:

Let A = dimension from surface plate to top of roll
R = radius of roll
α = included angle of taper
X and Y as shown

Then:

$$Y = \csc\left(\frac{90^\circ - \frac{1}{2}\alpha}{2}\right) R$$

$$= \csc\left(\frac{180^\circ - \alpha}{4}\right) R$$

$$X = Y \sin\left(\frac{90^\circ - \frac{1}{2}\alpha}{2} + \alpha\right)$$

$$= Y\left(\sin\frac{180^\circ + 3\alpha}{4}\right)$$

$$X = R\left[\csc\left(\frac{180^\circ - \alpha}{4}\right)\right] \times \left[\sin\left(\frac{180^\circ + 3\alpha}{4}\right)\right]$$

$$= I_{\text{x}}\left[\frac{\sin\left(\frac{180^\circ + 3\alpha}{4}\right)}{\sin\left(\frac{180^\circ - \alpha}{4}\right)}\right]$$

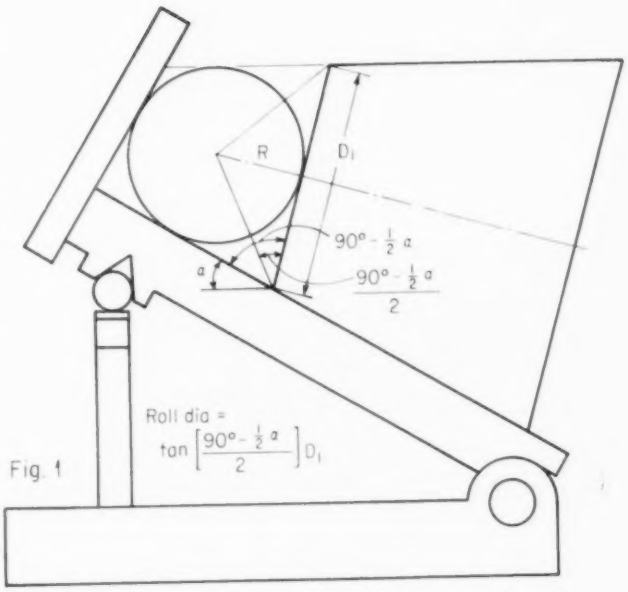

Fig. 1

Original method for measuring wire readings and major diameters on tapered threads: Wire or roll ground to achieve tangency with upper element of cone (extended). Roll required for checking each size of plug

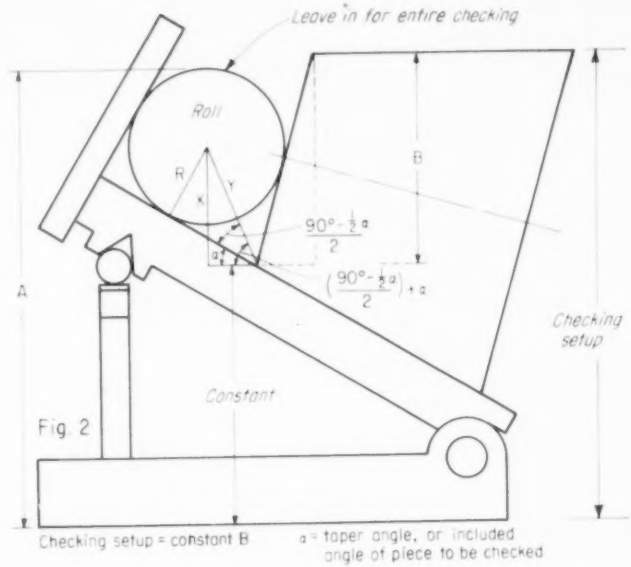

Fig. 2

New method will use existing rolls of known size between one quarter and three quarters the diameter at the small end of the tapered plug. Used for plain or thread plugs

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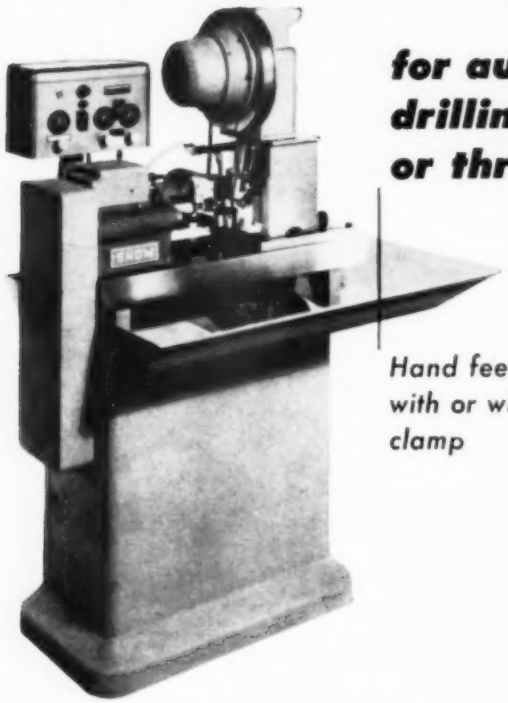
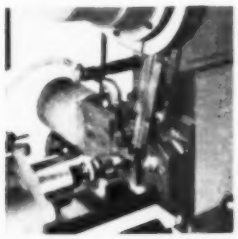


for automatic drilling, tapping or threading

Hand feed or hopper feed with or without air-operated clamp

NOW ...drill rivets faster with minimum tooling costs



Drills 500-3600 per hour; hopper feed; air-operated clamping. Capacity #74 (.0225") to ⅜" in mild steel.

Taps 4000 per hour hand feed magazine. Capacity #0 to ⅜" fine pitch in mild steel.

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Talking Shop...

At Last!

A SECRET AMBITION for a long time has been to put a genuine metal cover around this magazine. If you've received your Buyer's Guide Issue by now, you know that we finally made it. The cover is a thin sheet of pure aluminum bonded to paper. The trail that led to this feat is lined with blood shed by production men in the printing business who faced the problems of handling it in such volume and speed as required for a magazine like AMERICAN MACHINIST. Quite a few of them told us it couldn't be done before they went ahead and did it. The first question most people ask us is "Who made the aluminum for the cover?" The answer is that we slipped out quietly and bought it from a local distributor who is sworn to secrecy. So if you happen to make aluminum the answer is, *maybe* you did.

Even Trade

WE ADMIRE our 1959 auto immensely, and it has given us none of the trouble with bugs encountered in recent years, but there was a day recently when we would have made an even trade for a 1934 car. We sat in Milwaukee Arena eating a box lunch and drinking beer while Brooks Stevens entertained us with antique automobiles. When he rode into the Arena in a polished yellow 1934 Packard Double Cowl Phaeton we were prepared to trade right then—and so was an arena full of production men who were taking time out from discussions to eat lunch and admire old cars.

That box lunch, incidentally, was the brain child of Bob Dimberg of Allen Bradley, who knew that if the conferees ever scattered to the Milwaukee restaurants for lunch, he'd never get them back for the afternoon sessions.

Prophecy Confirmed

PERHAPS YOU recall that back in 1956 a group of automotive design and production men vastly entertained and instructed a Detroit audience with a detailed mythical case study of automation for the Heliotrac (*AM*—Jan 30 '56, p125). The earnest young chief engineer of the Heliotrac company talked his peers into putting a pancake aluminum engine in the rear while the production men were selling the management on automating the production.

Some months later we asked the man who played the role of the chief engineer when he would put such an engine in a real car. His answer: "Sooner than you think."

That able and candid gentleman was Ed Cole, who is today general manager of Chevrolet, and when you get your first chance this week to drive the Chevrolet Corvair with its horizontally opposed aluminum engine in the rear you might recall that Ed told everyone why it was a good idea—and told it convincingly—three and a half years ago.

Quiet Plant

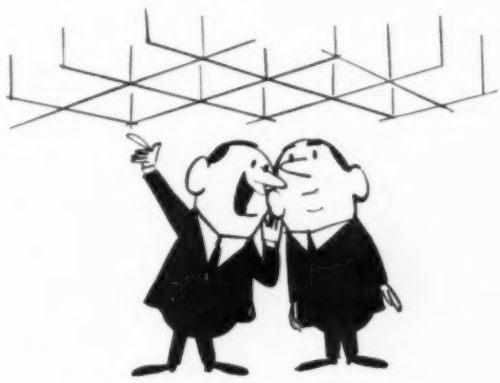
WE WERE IN a plant recently where an earnest effort was being made to hold down plant noise. Shields had been erected around the large multi-spindle automatics in one shop to confine some of the noise. In the pressroom vertical paper baffles were suspended in a checkerboard pattern above the presses to break up the sound waves. We wouldn't really call either shop quiet, but we would say that they were quieter than usual.

End of an Era

LONG BEFORE the word automation was coined, the principles were applied to a plant in Milwaukee where A O Smith made auto frames. This plant was perhaps the first extensive application of the basic concept of automation in a metalworking plant. It was back in 1927 that the plant first began operation and it was successful beyond the wildest dreams of the men who planned it. After a good deal of early publicity the plant was sort of forgotten by the general public but the plant—with annual tooling modifications—went on producing frames year after year.

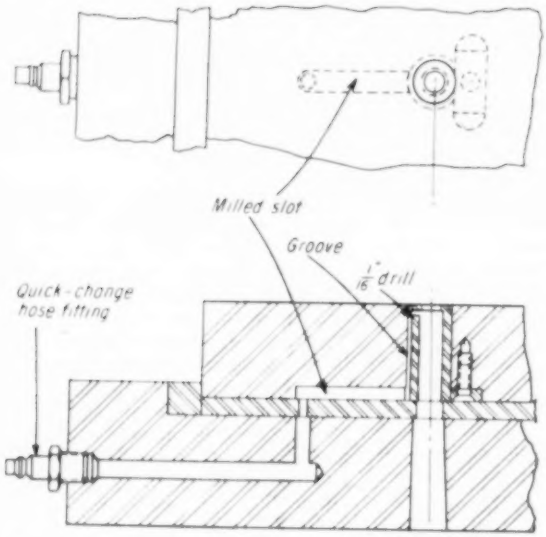
A few years ago an effort began to trace the origin of automation and the A O Smith plant was again in the public eye. It turned up in assorted historical reviews, was even more interesting for still being in operation.

But cars kept moving down toward the highway and this did what all the model changes of nearly three decades could not do. The frame began to change character radically—car by car it is even disappearing as the unitized body becomes more popular. The frame of today won't fit the plant so well designed so long ago. It has "ceased to exist" in the words of one A O Smith man.



Practical Ideas...

Injected Air Eliminates Shaving–Die Ejection Problem



The above sketch shows a tool design which is now standard in our firm when shaving holes in a progressive die. Previous to the adoption of this method, trouble with shavings pulling up and lodging between the top of the die and the work was experienced. Sometimes the shavings would not pass through the die, causing them to slug up and break the punch.

These problems have been effectively solved by injecting air between the punch and the shaving as soon as a shaving has been produced. This is all done automatically. When the press ram reaches the bottom of the stroke, an air valve is triggered to send a blast of air through a 1/16-in. hole into the bore of a die button, 1/16 in. below the die surface. The shavings, which in the case of a round hole are only thin rings, are then blown through the clearance hole of the die button and the die set.

Air is introduced through a hole drilled into the side of the die set and up into the recess receiving the die block. From there it travels through a slot milled on the bottom of the die block and up into a groove in the bore for the button die. Connection to the air line and valve is made through a quick-change hose fitting whose male section is screwed into the enlarged and tapped die set air hole.

We have found this approach best in solving our shaving problems in high-speed progressive dies. It has enabled us to operate our presses at from 100 to 300 rpm without slugging difficulties, but while this requires frequent replacements of die buttons, the cost of the buttons is negligible when the die is running smoothly.

David T Worth, chief tool engineer, Universal Tool Co, Dayton, Ohio

V-Grip Hold Works Better in Power Hack-Saw Vise

When cutting off thin-wall tubing in a power hack saw, there is a tendency to grip the work too tightly, to prevent slippage, with the result that the material is either flattened or crushed. Even solid round bar stock may rotate as the saw blade takes its initial cut, especially when a heavy feed is used, sometimes causing the blade to break.

Both of these conditions can be corrected by the illustrated V-grip or false jaw which is inserted between the stationary-vise jaw and the work. Because of the increased surface contact, less pressure is needed to prevent slipping, thus eliminating flattening.

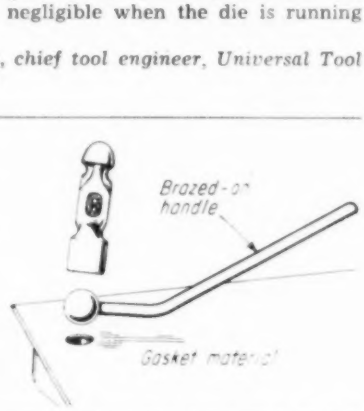
This V-grip is easily made. Simply lay a piece of steel angle into a steel channel of appropriate size and skip weld the two together as shown.

H J Gerber, Stillwater, Okla

Steel-Ball Tool Punches Gasket Material

A quick and easy way to punch a hole in a gasket is to place the gasket material on the flange, cylinder head, or whatever the component requiring the seal happens to be. Then place a steel ball on the material, over the hole, and strike it with a hammer. This is an old trick that works well, but it has one drawback. Every time you hit the ball it has a tendency of bouncing and getting away from you, sometimes forcing you to get down on your hands and knees looking for it.

To make this a more efficient operation, we have brazed small handles onto a number of different-size balls set aside for this purpose. These

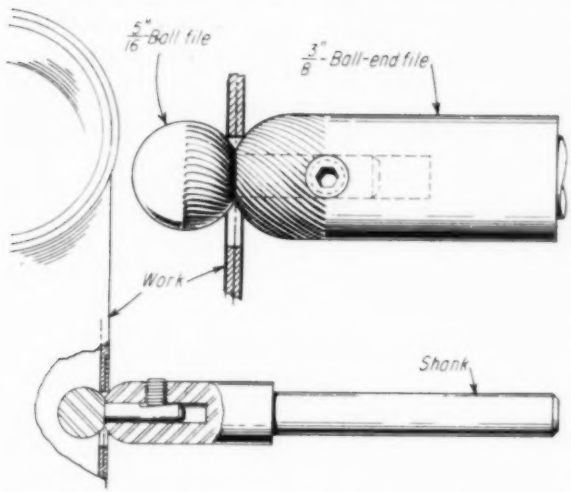


handles gives us a sure grip on the ball, we always know where it is, and work is speeded up.

When we're ready to punch a series of holes in a full gasket, we place the material on the part containing the clearance holes (never on the part with the tapped holes) and secure it with C-clamps. After finding the hole location with a ball-peen hammer, the ball tool is put in the indentation marking the hole and struck with a hammer. The process is repeated for each hole, and if a ball 25 to 50% larger than the hole diameter is used a neat clean hole through the gasket will result.

Harry J Miller, Sarasota, Fla

Stacked Rotary Files Deburr Both Ends of Holes in Tubes



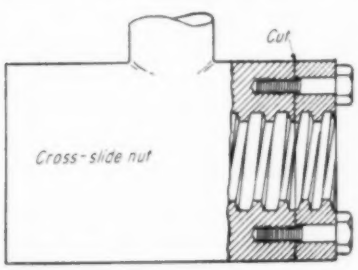
Our second step in the production of a large number of tube bends was to drill some holes into which smaller tubes were to be brazed. The material of the tubes was copper (in OD diameters from ½ to 1⅜ in.) making hole drilling without raising inside and outside burrs impossible. Since no burrs could be permitted on either side, I suggested we make a tool to reach through the hole deburring both ends without altering its diameter in any way.

The result was the stacked deburring tool shown. It consists of a 5/16-in. ball-rotary file mounted in the end of a ⅜-in. ball-end file. Both have helix-angled teeth cut in the same direction and are joined with a small setscrew into the side of the ⅜-in. file engaging a whistle notch in the shank of the smaller file. This notch provides a positive lock even after the mating faces have been ground back to present new teeth when files begin to show wear.

The tool shank can be gripped in either a drillpress or portable electric drill, depending on the size of the work and its convenience of handling. Holes are deburred by first inserting the ball file through the hole and then starting the machine. One pass around the edge of the hole cleans burrs off both sides of the tube wall. RPM can't be given to cover all situations because of the different characteristics in cutters, materials, and shape of parts. Each case calls for a little experimentation to find the proper rate of speed.

As for durability, six tools were made in anticipation of wear, but so far only two have been used, one for hard copper with which we have deburred about 1000 holes. With the other we have cleared several thousand holes in soft copper.

Robert A Smith, Dayton, Ohio



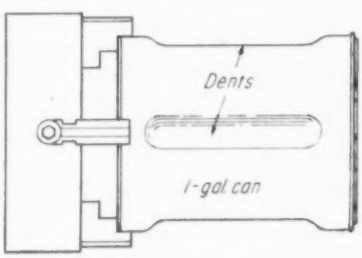
Emergency Repair Improves Lathe Cross-Slide Nut

A job had recently been started in the lathe when we discovered that we had too much wear in the cross-slide nut for it to function sufficiently accurate. There was no time to make or order a new one, but we remedied the situation without delay with the temporary dodge shown.

The nut was removed from the cross-slide and drilled and tapped in one end to accept two capscrews parallel to the axis of the nut. A slitting saw was then used to separate a portion of the nut from the rest. After the two capscrew holes in the cut off piece had been drilled up to clearance size, it was put back onto the nut and tightened securely.

This procedure changed the thread pitch relationship between the two sections to form a close fit of the nut on the screw. Naturally, if a nut isn't worn too badly, or if too much metal is removed, this method will cause the nut to bind on the screw. If this happens, shims can be inserted between the sections to establish proper relationship for complete backlash removal.

C M Roestenburg, Salt Lake City, Utah



Improvised Tumbling Barrel Made From Gallon Can

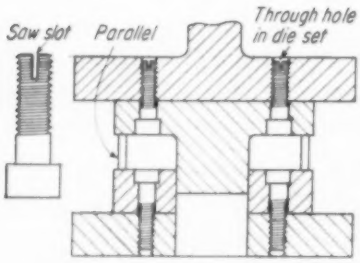
Deburring and polishing small parts are best done in a tumbling barrel. But when the output is too small to require standard equipment, it's easy to improvise and get good results in your own shop.

You can do this by preparing a gallon can to produce the same effect a tumbling barrel gives you. First remove the handle from the can and then make four long dents into the sides of it to create ribs for lifting and turning. Next put the parts into the can together with the abrasive, abrasive cloth, paper, rags, or whatever will do for your particular job. Press the cover tightly in place; you may even secure it with some tape to make sure it doesn't open during tumbling.

After the can has been mounted in the lathe chuck, slightly off center, set the spindle in back gears and allow the can to rotate for about 20 minutes. This time may vary with different material and abrasives, but it's a good starter. At practically no cost, and with no previous experience, a surprisingly good job can in this way be done.

Isadore Schiff, Morris Plains, NJ

Practical Ideas...



Screwdriver Slot Simplifies Punch Mounting

Did you ever run into trouble securing the punch to the die set after aligining the punch with the already mounted die? If you have, the illustrated kink may just be the thing to eliminate this problem.

Here's how we proceed. When drilling the mounting holes for the punch, we always make it our business to drill at least two of them through the die set. These holes are also tapped all the way through and the screws for them are a little longer than the rest and provided with a screwdriver slot on the threaded ends.

Now, when the punch has been positioned as desired, with the aid of parallels as spacers, it is secured from the top of the die set—using a screwdriver to tighten the screws. The die set is then opened and the screws given a final tightening with a hex wrench. After a double check, to see that the punch hasn't shifted, dowel-pin holes are drilled and reamed through the die set.

Robert F Noga, Fairfield, Conn

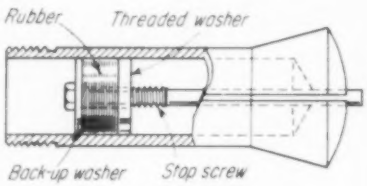
How To Center a Keyway Cutter

Here is a quick and easy way to center a milling cutter with a round shaft for cutting a keyway. It is done without measuring or calculating, and yet with sufficient accuracy for standard keyway-cutting practices.

First set up the shaft into which the keyway is to be cut, in whatever manner is most convenient, as in the vise, in V-blocks, or clamped to the machine table. Next, the correct-width milling cutter, being mounted on the arbor, is roughly centered over the shaft where the keyway is to be located. As the cutter rotates, raise the table to mill a flat, moving only the crossfeed and again increasing the cut until a flat, 1/32 in. wider than the cutter, is produced.

Center the cutter by sight with this flat so that an equal amount of flatness can be seen on each side of the cutter. The center of the shaft has now been found and the crossfeed can be locked. This also gives the starting point of the keyway depth relative to this width and to the shaft diameter. Therefore, set table-height dial to zero, and if the keyway is to be started from the end of the shaft or some other position, move to this position with the table lowered. Then come back to zero and feed up until you get to the desired depth of the keyway.

Kenneth Heyer, Inglewood, Calif



Rubber Anchors Collet Stop

Here is a simple yet effective collet stop that, when secured inside a collet, will insure uniform work lengths. It is designed to be locked in the unslit section of the collet so with different-length stop screws it will have a depth capacity of from inches (depending on the length of collet) to a fraction of an inch.

The main body of the stop is a thick washer of rubber sandwiched between two steel washers. All three components are made a little oversize with clearance drilled in the rubber and one washer. The second washer is tapped to receive a combination locking and stop screw. After the steel washers have been turned down to a diameter slightly under that of the collet's ID, the rubber is assembled between them and tightened only enough to hold the parts together. With the screw gripped in a collet, the rubber is machined to the steel-washer diameter. Stop screws should be faced off to present good contact surfaces.

When the desired length screw has been selected, the parts are assembled and the unit is entered into the collet for its locating and locking.

Ralph Whitney, Framingham, Mass

Fred P Faltersack
San Jose, Calif

WON

$25 in addition to regular payment for his idea:

DRILLPRESS MICROMETER-DEPTH STOP

in the Aug 10, 1959 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

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JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

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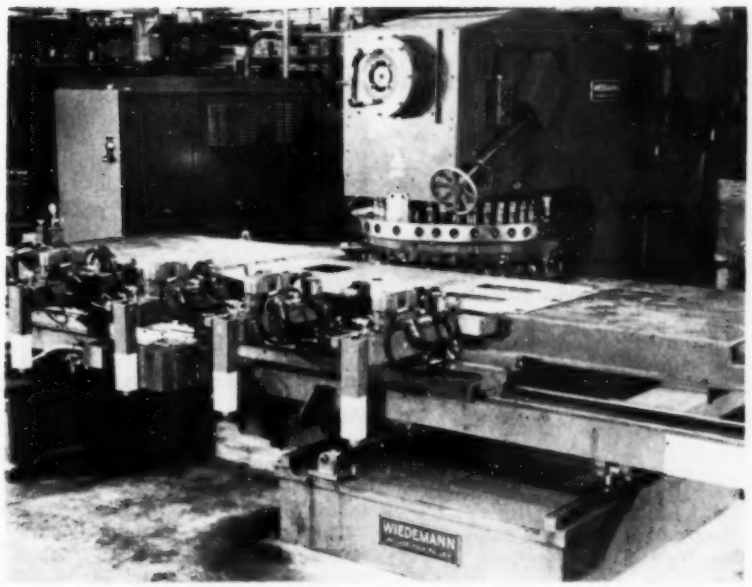
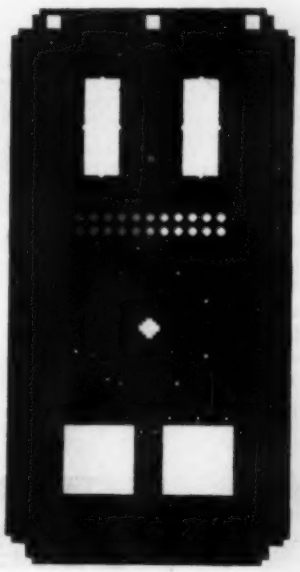
New Shop Equipment
Materials and Parts





Wiedemann Offers New Tape-Controlled Turret Punch Press

Designed specifically for numerical positioning control, this new A-100 Wiedematic turret punch press is reported to provide the fastest and most consistently accurate method of short-run piercing. All press functions—tool selection, material positioning, and piercing—are controlled automatically by a modified General Electric Mark III numerical positioning control (*AM*—Oct 20 '58, p210).

The press, now in operation at GE's Specialty Control Department, Waynesboro, Va, has a capacity of 100 tons and a throat depth of 63 in. It can pierce sheet metal or plate up to 60 x 100 in. x ⅜ in. thick in a single handling at a production rate of approximately 30 hits per minute. This makes it about three to five times as fast as a non-automated Wiedemann of the same size. Hole positioning accuracy is ±0.010 in.

Simplified operation

Operation of the Wiedematic is reduced to pushbutton simplicity. All the required information to complete a job is programmed into a standard 8-channel, 1-in.-wide paper tape. The operator simply loads the material on the press table, inserts the tape in the reader, and starts the press. Simultaneously, the material is moved in-or-out and crosswise to the designated centerline dimension at a speed of 600 to 800 inches per minute, while the turrets rotate to bring the proper punch and die (anyone of the 36 mounted in the turrets) into piercing position in less than two seconds.

During the piercing operation, the information for the next hole is read, and the table and turrets move to the designated position as soon as the previous hole has been completed.

Tape is prepared with either a standard tape punching machine, working from a simple work chart listing the X and Y dimensions and turret station number for each opening, or by an Auto-progammer developed by GE. This unit can prepare a tape from a dimensionless scale drawing, and is presently being used to prepare tapes for the new Wiedematic A-100. The Auto-programmer can reduce drafting time about 75%.

Automatic workholders

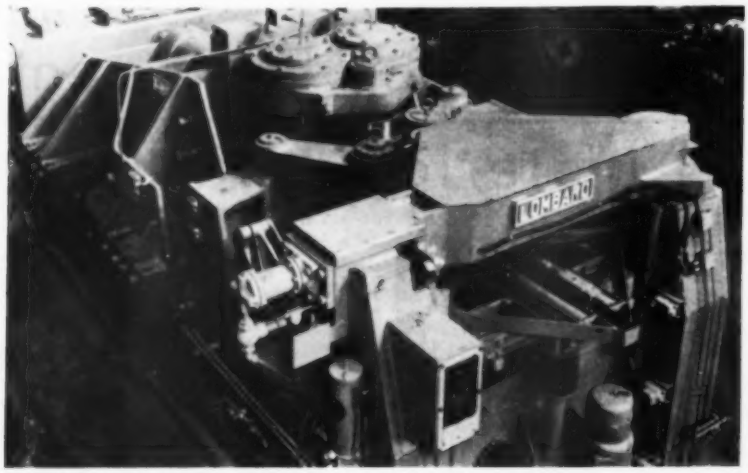
Automatic workholders, sensitive to signals generated by proximity pickups, permit punching close to the edge of the sheet. When the pick-up head registers with a profile cam located in front of the turrets, the workholder jaws open and the clamp retracts. When the head moves away the workholder returns and reclamps the sheet.

Typical workpiece

Illustrated above is a typical job pierced in a single handling on this machine. The sheet measures 48 x 80 x ⅛ in. Job required 208 strokes of the press and seven different size tools. The large openings and corner notches were made with a 2 x 2-in. tool. Total piercing time was approximately nine minutes.

Wiedemann Machine Co, Gulph Road, King of Prussia, Penna

MORE DATA? Circle 51, inside back cover



RING ROLLING MILL receives heated steel rings with cross-sectional area of 3 sq in. and ID of 15 in. and automatically delivers a predetermined sectional contour with OD as high as 50 in. Basic components of the mill are main roll, pressure roll, back-up arm, guide rolls, operating cylinders, carriage and tilt table. Pressure of over 200,000 lbs can be applied to product being processed between main and pressure rolls. Machine, which occupies an area of 22 x 10 ft, is controlled from operator's pulpit—*Lombard Corp, 639 Wick Ave, Youngstown 1, Ohio*

MORE DATA? Circle 54, inside back cover

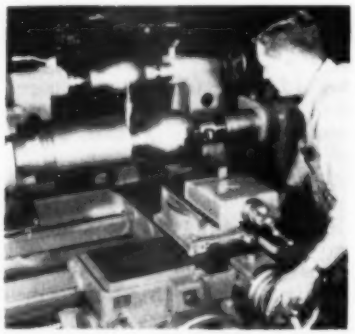
Wheel Forming Attachment Offered For Toolroom Surface Grinders

Diaform Model 5 is designed for permanent mounting on machine's spindle head so that it is immediately available when needed to form-true or re-true the grinding wheel yet out of the way of form grinding operations. In using the attachment, operator traverses a tracer over the profile of an easily made templet and the path of the tracer is transmitted, at a 5:1 or 10:1 reduction ratio, to the truing diamonds which form-true the grinding wheel to desired shape. The entire job can be performed in minutes and the wheel is form-trued accurate to a few ten thousandths of an inch.

Unit is supplied in two sizes: Model No. 5-1 (for surface grinders with table working surfaces of approx 6 x 18 in.) will form wheels up to 7 in. dia by 1-in. face. Model No. 5-2 (for grinders with surfaces of approx 8 x 24 in.) will process wheels up to 10 x 2 in.

Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn

MORE DATA? Circle 55, inside back cover



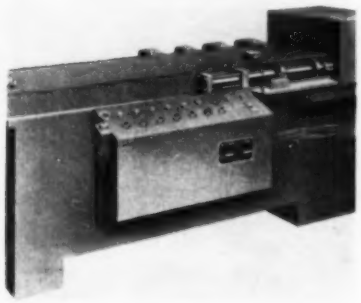
LeBlond Adds 90° Hydraulic Tracer

A 90° tracer that will trace from either flat or round templets is designed for use on LeBlond Standard and Heavy-Duty lathes. It can be used to tracer-turn stepped shafts, spindles, gear blanks, forming rolls, arbors, axles, cones, sheaves, pistons and balls.

The templet is mounted between centers behind the workpiece and the tracing stylus contacts it from below. In-and-out rapid traverse ranges to 80 ipm and variable hydraulic feed to 45 ipm. It can be switched to standard operation in 30 seconds. Tracer will resist pressures of 6000 lb at the tool tip, yet produce templet contours to 0.001 in. on diameter and shoulder length.

LeBlond Machine Tool Co, Cincinnati 8, Ohio

MORE DATA? Circle 56, inside back cover



Circular Saw Designed To Cut Aluminum, Brass

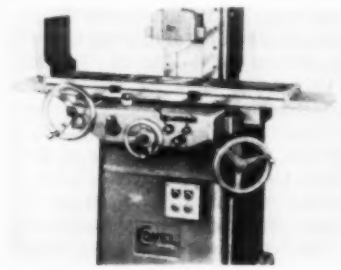
Model V-4 circular saw with fully automatic operation is designed for high production cutting of aluminum and brass extrusions, bar stock and tubing up to 4x4 in. thick.

The machine is set to feed automatically by holes or other characteristic stamped into the materials. It will cycle 1 to 20 times a minute.

The 16-in. blade is powered by a 5-hp motor and has a rim speed of 7,000 rpm. Coolant capacity is 5 gal, pump capacity 4 gal, hydraulic reservoir 30 gal. Machine weighs 2200 lbs.

W F Wells and Sons, Three Rivers, Mich

MORE DATA? Circle 57, inside back cover



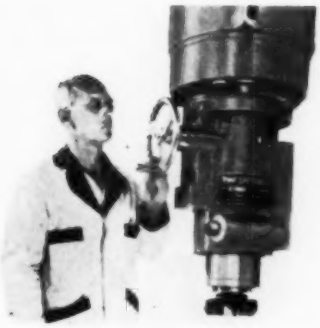
Covel Hydraulic Surface Grinder Has 16½-in. Vertical Capacity

No. 10H 6 x 18-in. unit is designed with 16½-in. vertical capacity from full 7-in.-dia wheel to top of table. Infinitely adjustable cross feed range is from 0.005 to 0.250 in. with rapid traverse for dressing the wheel from

the chuck or quick positioning of work. Added features include power elevation for rapid positioning of the grinding wheels, and inverted V cross ways.

Covel Mfg Co, Benton Harbor, Mich

MORE DATA? Circle 58, inside back cover



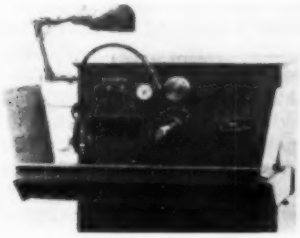
Veet Speedmiller Converts Planer To High-Production Planer Mill

Veet Speedmiller, designed especially for machine conversions, is a two speed milling head rated at 30 hp at 900 rpm and 15 hp at 450 rpm. As a two-speed unit it is capable of milling all grades of steel and cast iron. Machine changes required are essentially a matter of providing milling feed rates for the table and motorizing the cross-rail.

Cost of conversion is said to be about 10% of cost of a new machine with the same capacity. Increases in production of as much as 275% are reported possible.

Veet Industries, 25753 Groesbeck Hwy, East Detroit, Mich

MORE DATA? Circle 59, inside back cover



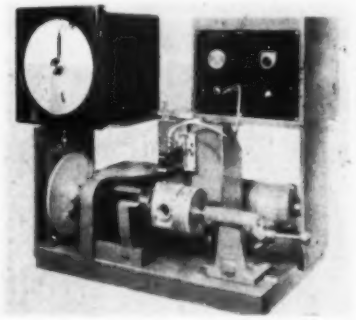
Automatic Honer Offered for Production Runs, Toolroom Work

Model J2 provides infinitely adjustable spindle speeds from 225-525 rpm on an optional range of 450-1050 rpm. It is powered by a ½-hp 110-v 60-c single-phase motor. Complete drive, motor, and coolant tank are enclosed in a heavy steel base.

Additional features include a tray top, sealed ball bearing spindle, splash guards, and anti-splash screen in the coolant tray. The 14-gal. coolant tank is removable for easy cleaning. All wiring connects to the main outlet box so that only one extension cord is required. Optional equipment includes a dial indicator, full width extension tray, and filter tray with three settling baffles and burlap filter. Price is $495 fob.

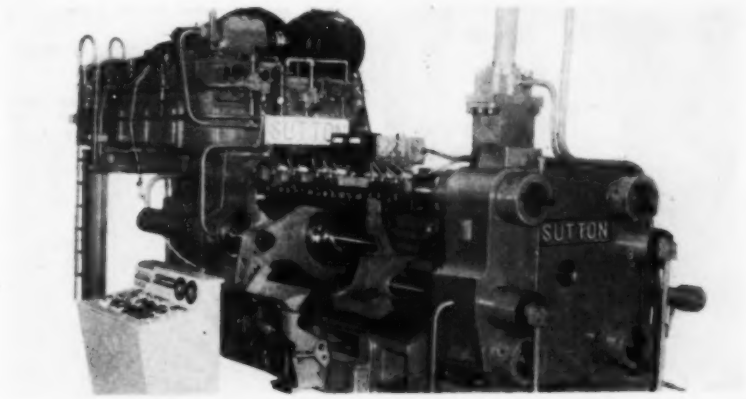
Superior Hone Corp, 1607 Elreno St, Elkhart, Ind

MORE DATA? Circle 61, inside back cover



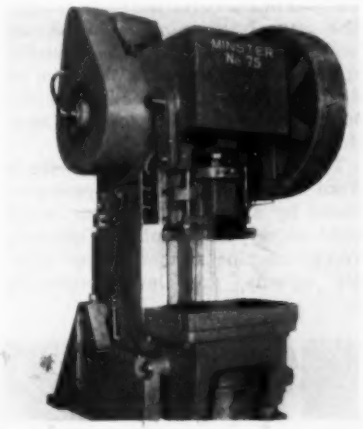
OUT-OF-ROUND MEASUREMENTS to 0.0002 in. can be made on this RCA contour inspection machine. After cylindrical part is clamped in fixture, machine rotates part through 360 deg, while measuring changes in diameter per degree of rotation. Measurements are recorded on a polar chart. Machine completes test and automatically stops in 60 sec—*Radio Corporation of America, Industrial and Automation Div, 12605 Arnold Ave, Detroit 39, Mich*

MORE DATA? Circle 62, inside back cover



1250-1500 TON HORIZONTAL HYDRAULIC EXTRUSION PRESS built for Saramar Aluminum Co is being used at company's Youngstown, Ohio, plant for extrusion of aluminum sections for the building industry. Unit is reportedly increasing output by 40%—*Sutton Engineering Co, First National Bank Bldg, Pittsburgh 22, Penna*

MORE DATA? Circle 60, inside back cover



Lubrication System Trims Costs On 75-Ton Inclinable Press

The optional recirculating lubrication system of this improved 75-ton inclinable press is said to lower maintenance and clean-up costs as well as prolong press life. Optional system continuously lubricates main and connection bearings, gibs, gears and counterbalances. The improved model also incorporates a modified flanged slide, yielding a larger die area. A combination air friction clutch and brake unit provides torque overload control, higher tripping efficiency and controlled cycling and inching, the manufacturer reports. A double screw arrangement, located at normal working height, inclines the press manually. Press is available in either flywheel or gear type.

Minster Machine Co, Minster, Ohio

MORE DATA? Circle 63, inside back cover

4-in. Capacity Pipe Machine Has Tangential Die Heads, Chasers

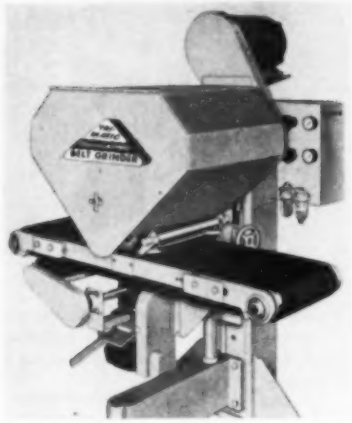
Model 784-T pipe machine, equipped with tangential die heads and chasers has a standard range of 1 to 4 in. and an extra range of ½ and ¾ in. pipe.

Two quick-opening, lever-operated die heads cover the entire range. The large head is mounted permanently on the machine and the smaller head is mounted on the face of the large head. This mounting method is said to eliminate constant head changing.

The machine is equipped with a front chuck that can be opened or closed by a handwheel. Rear chuck and extra long spindle provide maximum pipe support. Four spindle speeds are lever-controlled. Power is supplied by a 5-hp, 1800 rpm motor.

Oster Mfg Co, 1340 E 289th St, Wickliffe, Ohio

MORE DATA? Circle 64, inside back cover

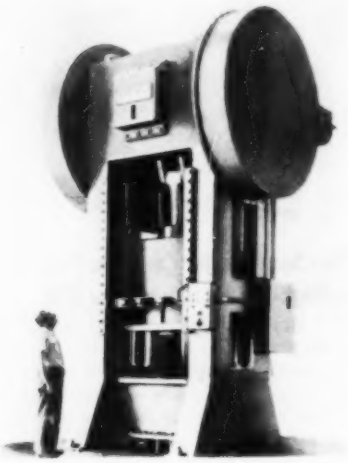


Oscillating Belt Grinder Prolongs Belt Life

An oscillating belt grinder will perform deburring, descaling, grinding and polishing. Machine is said to cut faster and have longer belt life than other units of its type because of the shearing action of the oscillating belt. Belt oscillation is maintained and controlled by an air jet sensing device, feeding into electronic controls which adjust lateral travel and lateral travel speed. Oscillation is said to be produced without undue tension on the belt. Abrasive belt clearance is adjustable from zero to 5 in. above conveyor belt. Conveyor travels from 60 to 120 in. per min. It is called Tri-matic Oscillating Belt Grinder.

Sales Service Manufacturing Co, 2363 University Ave, St Paul 14, Minn

MORE DATA? Circle 65, inside back cover



Machinery Design of New Presses Steps Up Operating Speed by 80%

New line of Steelweld Speed-Draw presses incorporates a patented machinery design that is claimed to step up operating speed over standard mechanical presses by 80%. Press, particularly suited for deep-draw applications (can also be used for standard press applications) permits making extra long draws at higher speeds than shallow draws can be made on a standard crank-type unit. Deep-draw feature frequently makes it possible to reduce the number of operations required to form a part and will permit some operations that are not usually possible on a press.

A simple, toggle-eccentric mechanism travels the slide at an essentially uniform rate during the down stroke with no acceleration irregularities and at a much increased rate during the up stroke. Modified connection between eccentric and slide uses a full eccentric shaft of shorter throw than indicated by the length of stroke. As a result, the mid-point capacity is equal to 50% of the regular rated capacity. Since presses for draw work are generally selected by mid-stroke tonnage, this means that a smaller Speed-Draw press than normally re-

ANNEALING FURNACE, installed at Webcor's laminations division, is 120 ft long, can convey up to 4500 lbs of steel laminations per hr at temperatures ranging from 1500 to 1700 F. Conveyor system handles the entire process from punchpresses, to and through the furnace, to packing and loading areas—*Lindberg Engineering Co, 2450 W Hubbard St, Chicago 12, Ill*

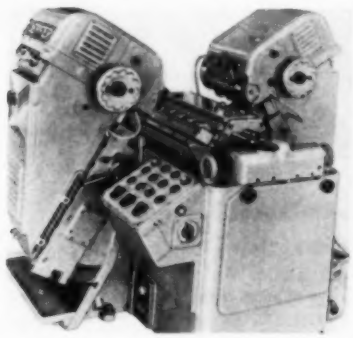
MORE DATA? Circle 66, inside back cover

quired can be used for a given job.

Units are available with 1, 2, or 4-point suspension, and for single and double action. They will take die cushions to provide blank-holding pressure for draw work. Models are furnished in capacities of 200 tons (based on ¾ in. from bottom of stroke) and up. Standard bolster areas start with 30 x 36 in. and standard slide areas start with 30 x 30 in. and range upward.

Steelweld Machinery Div, Cleveland Crane & Engrg Co, Wickliffe, Ohio

MORE DATA? Circle 67, inside back cover



Koepfer Rack Cutters Reduce Production Time and Cost

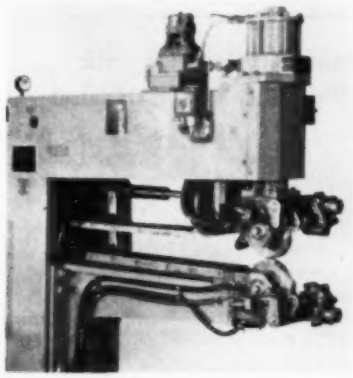
Units automatically produce racks for all types of office, tool, and scientific machinery from simple typewriters to complicated electronics computers.

Two models are available, the 205 and the 210 with one or two cutting heads. Model 210 has a larger cutting length. Second cutting head may be added to double production rates. Various cutting tools are available —from a single to a gang of annular form cutters. Capacities are limited only by the size of cuts being made. Cycling is automatic. Plunge cutting, climb milling, dimensional milling, traverse feed, and in-feed are automatically controlled through a built-in selector panel; skip milling is accomplished through a special cam mechanism. Built-in, quick-set indexing device is reported to be extremely accurate and to retain accuracy through long production runs. Fast traverse of the cutter heads and the worktable, together with the combination of plunge-longitudinal feed, reduce cutting cycle to a minimum. Rate of spindle speeds is adjustable from 80 to 645 rpm. Worktable surfaces, slanted 30° to simplify setup time and disposal of chips and coolant, are wide enough to take several workpieces at a time. Cutting head swivels 20° to either side of the line of traverse to produce skewracks.

Max cutting length on the 205 is 20 in.; on the 210 model, 40 in. Max cutting width is 4 in.; max pitch capacity steel, DP 6; cast iron, DP 5.

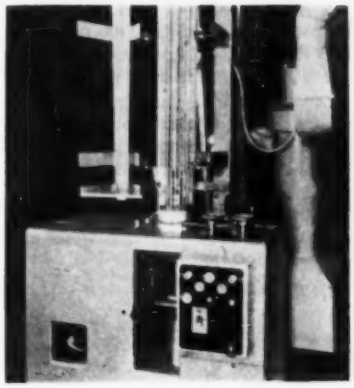
Distributed by Cosa Corp, 405 Lexington Ave, New York, NY

MORE DATA? Circle 68, inside back cover



SEAM WELDER LINE consists of three sizes ranging from 50 to 400 kva, with each size available as a circular, longitudinal, or universal machine. Units are equipped with a new anti-friction slide—*Federal Machine and Welder Co, Warren, Ohio*

MORE DATA? Circle 69, inside back cover



Vertical Cutoff Saw Speeds Cutting of Tubing and Solids

Saw that cuts all shapes of tubing and solids including copper, brass, aluminum, steel, and plastic, has a max production rate that ranges from 100,000 pieces per hr for 3/16-in. dia tubing to 25,000 piece per hr for 1-in. dia. This is said to be at least 10 times greater than the rate possible with horizontal high-speed machines. Machine produces burr-free lengths of from ¼ to 7 in. with closer than commercial tolerances. No distortion in roundness of light walled tubing is reported to result. Material up to 20 ft in length is fed vertically.

Unit has completely enclosed saw

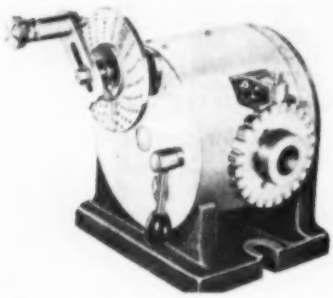
FOUR AND SIX CYLINDER ENGINE BLOCKS are processed at rates of 50 and 45 parts per hour, respectively, on this line boring machine. Unit finish line bores the crankshaft and camshaft bearing diameters, finish bores two dowel holes, and finish bores, chamfers and faces the distributor drive hole. Blocks can be fed into the machine indiscriminately—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich*

MORE DATA? Circle 70, inside back cover

blade and vacuum type chip collector. End pieces are automatically separated from finished pieces and dropped out the scrap chute at rear. All mechanical operations are controlled through control panel, variable speed indicator, and adjustable tube stops. Floor space required is 40 x 50 in.

National Copper & Smelting Co, Cleveland 6, Ohio

MORE DATA? Circle 71, inside back cover

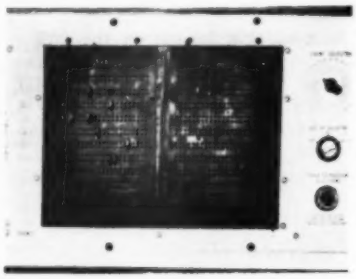


Direct Indexing Heads Available For All L-W Chuck Dividing Heads

New models permit changing from conventional indexing to direct indexing in less than a minute. Worm and wheel adjustment eliminates backlash. A 24-slotted plate is standard equipment with direct indexing models. Machine blanks can also be furnished.

L-W Chuck Co, 25 S St Clair St, Toledo 4, Ohio

MORE DATA? Circle 72, inside back cover



Cincinnati Offers Automatic Milling Machine Cycle Control

Telmatic, an automatic milling machine cycle control with a peg-board control panel has been introduced by Cincinnati Milling Machine Co for use with their 200 Series Hypowermatic Milling Machine.

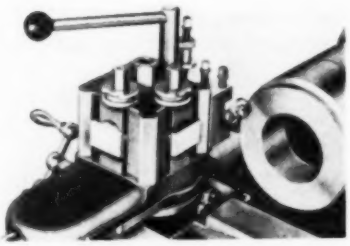
The control panel controls all functions of the machine and includes provisions for auxiliary operations such as fixture clamping or indexing. For each machine function there is a row of 24 holes which allows the operator to peg-in milling cycles involving up to 24 steps. Panels with more than 24 events can be supplied.

Setup consists of inserting plugs in holes opposite the desired function in proper sequence. Trip dogs on the machine table and spindle carrier initiate actions and the control system directs the action. The operator may stop the machine at any part of the cycle and resume the cycle without returning to the starting point. Accurate stop within 0.001 in. can be pegged in.

Tracer control can be programmed into the cycle and templets are available which can be superimposed over the control panel for re-runs.

Cincinnati Milling Machine Co, Cincinnati 9, Ohio

MORE DATA? Circle 74, inside back cover



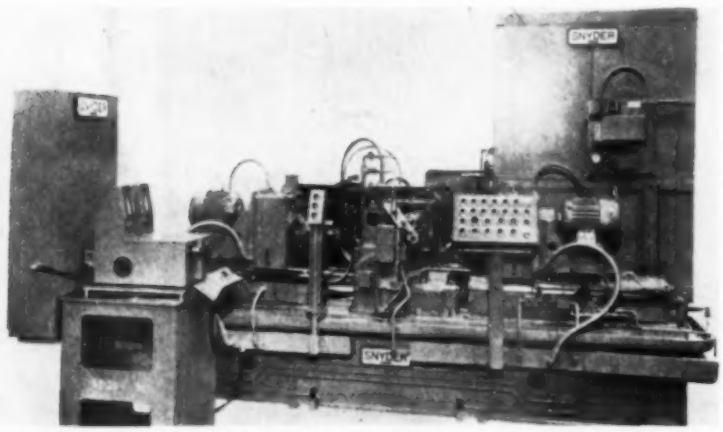
Quick-Change Tool Holder Speeds Setup Time on Lathes

Boni Master Multi-Tool Holder maintains repeat precision accuracy of 0.0001 in. Unit can be used for large production, small runs, or individual work. It can take heavy as well as light cuts with precision because of design and rigidity.

Adjustments of the cutters in their respective holders to the proper height are made with adjusting screws, eliminating need for shims. Replacement of one exchange holder and cutter with the one for the next operation is made in a matter of seconds; tool changes that can be made are unlimited. Unit can be furnished in five sizes covering a range of lathes from 1 to 35 hp.

Distributed by Karl A Neise, 40½ Fourth Ave, New York 16, NY

MORE DATA? Circle 75, inside back cover



AUTOMOTIVE CONNECTING RODS are weighed and machined to a ± 1/16-oz weight tolerance at a production rate of 313 parts per hr at 100% efficiency on this 3-way precision balance milling machine. Extreme precision in weight of parts produced is the result of an electronic-memory weighing system that accurately controls depth of feed of the machining units, and a method of providing electrical compensation in the depth control of a drill spindle. This electrical compensation system accurately allows for variation in metal removal caused by the point of the drill—*Snyder Corp, 3400 E Lafayette, Detroit 7, Mich*

MORE DATA? Circle 73, inside back cover

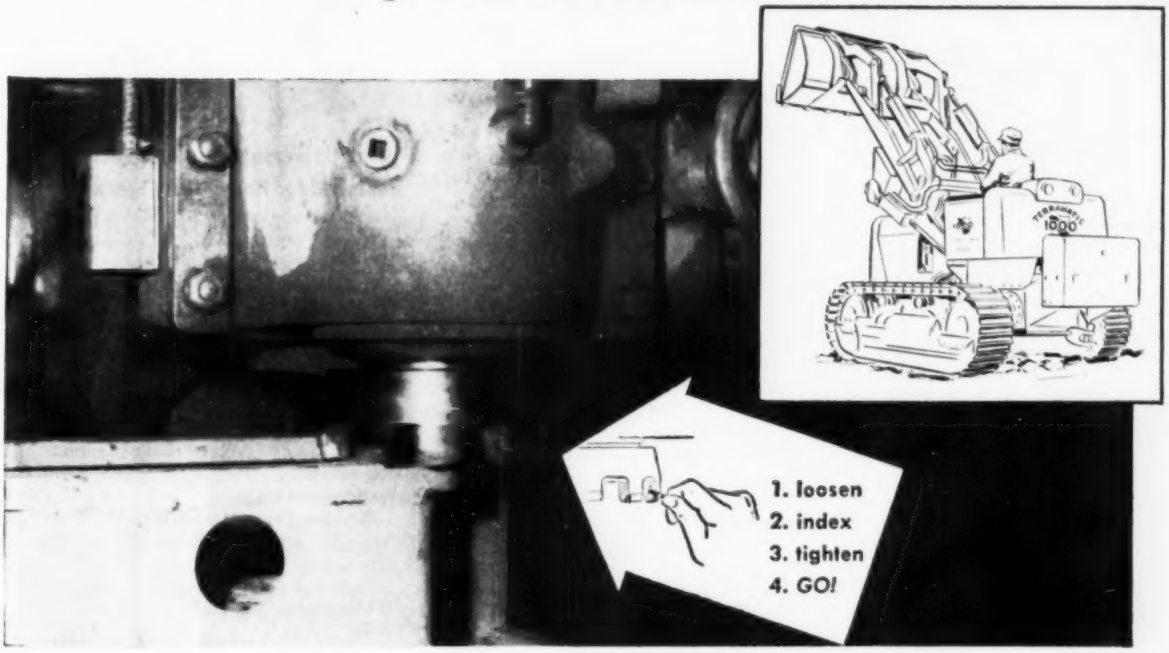
Tungsen Alloy Electrode Offered for Spark Machining

Tungsten alloy electrodes called Sparkal-X are now available for use in electrical discharge machining. Measuring 13¾ in. long, they are offered in round or square sections from stock and in special shapes or sizes to order. According to the manufacturer, the erosion rate of Sparkal-X is superior to other electrodes. It is claimed that only 1 cu cm of Sparkal-X will remove 3.75 cu cm of hard metal, while 1 cu cm of brass would remove only 0.4 cu cm of the same metal.

Saturn Metallurgical Industries, 475 5th Ave, NY 17,

MORE DATA? Circle 76, inside back cover

Milling Cutters are dependable says J.I.CASE



16 months of continuous milling on TERRAMATIC transmission housings

It's no "pink tea party" when you chew a quarter-inch of rough 1015 Weldment Steel casting — spinning the milling cutter at 800 s.f.p.m. That milling cutter's got to be tough — *plenty tough* — and the carbide inserts need real "backbone."

J. I. Case found the right combination in V-R Face Mill Cutters with V-R throw-away carbide inserts. Big demand for Case Terratrac dozers, diggers, and crawlers, with Terramatic Transmission, has kept production lines humming — 2 and 3 shifts a day — 16 months continuous production. In this picture there's no place for excessive downtime, or delays for tool regrinding. V-R Face Mill Cutters provide cutting edges right on the job — a turn of a wrench — index the insert to a new cutting edge — tighten — and away you go! (Minimum maintenance problems, too: in *16 months production only 3 sets of main screws and 1 chip breaker plate needed replacing.*)

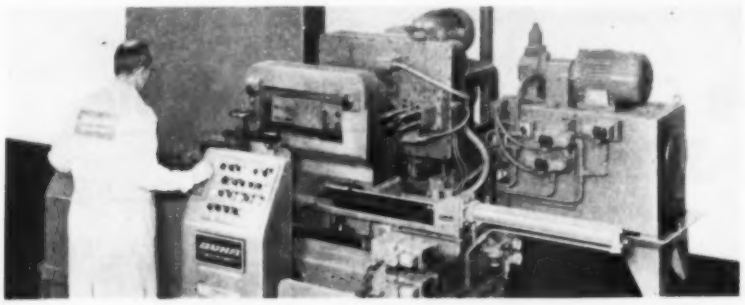
Your V-R representative has the facts on Face Mill Cutters and all carbide cutting tools — call him in today or send for Catalog VR-58.

Vascoloy-Ramet corporation

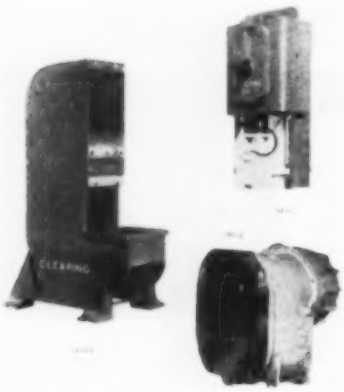
PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

844 Market Street • Waukegan, Illinois

FM-734



TRUCK FLYWHEEL HOUSINGS are machined on this combination shuttle-dial Economatic that automatically drills, chamfers, and taps a series of holes first on one side and then on the other side of the housing, all with a single hydraulic feed unit. Because standard components are used in simple combinations, machine can be easily converted to meet part design changes or to process an entirely different part. Complete automatic cycling time is 1-4/5 minutes—*Buhr Machine Tool Co, Ann Arbor, Mich* MORE DATA? Circle 77, inside back cover



Clearing Adds 60-Ton Model To Line of Modular Presses

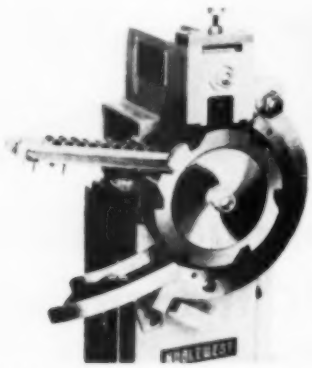
A 60-ton capacity machine has been added to the Torc-Pac line of modular OBI presses, which previously included only 22, 32 and 45-ton sizes. Each press is composed of three basic units—frame, drive and head—which are completely interchangeable.

This modular construction is said to solve many problems of maintenance and construction. For example, a replacement drive can serve as a standby unit for all the presses in a shop. Drive and head units can be used in special applications. One manufacturer fastened a drive and head unit to a girder to accomplish an operation that could not otherwise be accomplished because of height limitations.

The 60-ton press also features an air-friction clutch in which bronze friction plates are used instead of conventional asbestos - neoprene liners. In addition to lubricating and dissipating heat, the oil also absorbs the shock of the pickup load during engagement. The drives are sealed and guaranteed for 18 months.

Clearing Div of U S Industries, Inc, 6499 W 65th St, Chicago 38, Ill

MORE DATA? Circle 78, inside back cover



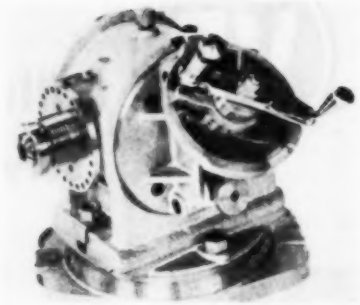
Noblewest Machine Auomatically Marks and Grooves Tubular Parts

Model 523 rolls an annular groove around tubular parts and marks the manufacturer's identification and part number at production speed of 5000 per hr. This is accomplished with a single roll forming die, without use of internal support or a female die, and with no distortion to the completed piece. Unit is shown tooled for grooving and marking tubular electrical connectors 1.062 and 0.855 in. in dia with a 0.062-in. wall thickness. In each case the groove is debossed so that the ID is reduced by approximately 0.195.

Specifications are 46¼ in. high; 24 in. wide; 18½ in. deep; weight, 400 lbs; motor, ½ hp variable speed.

Noble & Westbrook Mfg Co, East Hartford, Conn

MORE DATA? Circle 79, inside back cover



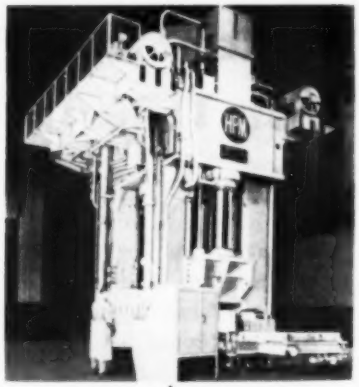
10-in. Universal Dividing Head Designed for Heavy-Duty Work

Model E, a trunnion-type unit, has indexing accuracy of 1 minute in 360°. Auxiliary swivel base (optional) provides 360° swiveling in longitudinal plane. Model is designed for compound indexing as well as direct and crank indexing, providing a wider range of divisions. Added features: 2-in. riser blocks (optional) for headstock and tailstock; quick worm disengagement for indexing; lifetime freedom from spindle backlash.

Accessories available include draw-in collet attachment for No. 5C collets up to 1-1/16-in. capacity.

Nicholas-Morris Corp, PO Box 430, White Plains, NY

MORE DATA? Circle 80, inside back cover



H-P-M HYDRAULIC PRESS, largest ever built for the Hidraw forming process, has a 7500-ton downward-acting slide with a 60-in. stroke and is equipped with a 6750-ton die cushion with a 26-in. stroke. Pressing area is 72 x 144 in. Max closing speed to the work and return speed is 600 ipm; pressing speed to full tonnage is from 4½ to 47½ ipm. All speeds are infinitely adjustable. Over-all height is 47½ ft with 15 ft below and 32½ ft above floor level—*Hydraulic Press Mfg Co, Mount Gilead, Ohio*

MORE DATA? Circle 81, inside back cover

Klingelnberg Hob Grinders are available in two models to sharpen 12" diameter hobs 12" and 16" long.

These are the features that sold Milwaukee Gear* on the KLINGELNBERG HOB GRINDER

...and keep them sold

1 Spacing of gashes is held closer on the Klingelnberg than on any other machine.

2 Large precision indexing plate, mounted directly on work arbor, guarantees accurate spacing.

3 Spiral lead is *mathematically* accurate through change gear train—not hampered by errors inherent in sine-bar settings.

4 Fully automatic cycle—grinding and spark out—enables *one operator to run two machines.*

5 Automatic wheel dresser is hydraulically operated, controlled from operator's stand.

Milwaukee Gear's plant superintendent, August Hemminger, puts it this way: "We continually grind hobs on the Klingelnberg machines within *new hob tolerances.*"

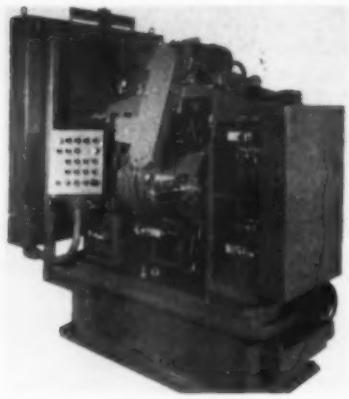
Isn't this the kind of accuracy you want in *your* hob grinding? Let us show you how the fully automatic Klingelnberg can give it to you. Write today.

*...and DeLaval; General Electric; Chevrolet; Allison Div. of GMC; Hyster; Chicago Gear; Industrial Gear; Philadelphia Gear; Cleveland Worm & Gear; Eberhard-Denver; Henry J. Thompson—and so many others.

KO CO., INC. PRECISION MACHINERY

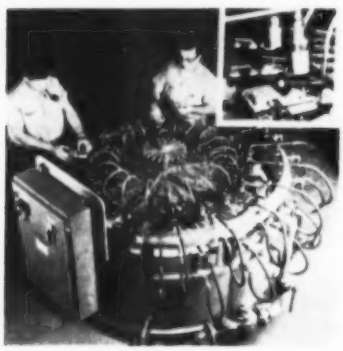
KURT ORBAN COMPANY, INC.

36 Exchange Place, Jersey City 2, New Jersey



FOUR OPPOSED HOLES are drilled and reamed in this 5-station automatic drilling and milling machine. Special machine, built for work on automobile starter clutch housings, drills and reams four 0.094-in. holes located 90 deg apart. Pieces are automatically indexed 180 deg between stations during operation. Machine cycle takes 8 sec. Five station sequence includes one load-unload operation, two drilling and two reaming operations — *Rehnberg-Jacobson Mfg Co, 2135 Kishwaukee St, Rockford, Ill*

MORE DATA? Circle 82, inside back cover



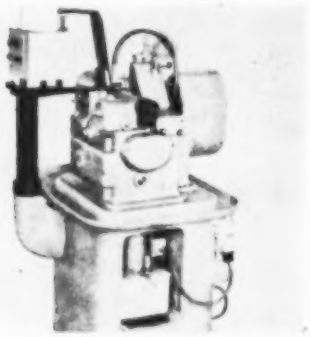
Self-Indexing Machine Brazes 600 Assemblies per Hour

Machine, designed and built for a leading automobile manufacturer, silver brazes a tube and flange to a tank, and has increased production to a rate of 600 assemblies per hr.

Automatic unit comprises 20 stations for loading, heating, cooling, and automatic unloading. Water-cooled, workholding fixture at each station holds the tube and flange in the proper relationship with the tank, and a device for maintaining alignment on the flange exerts pressure to assure its being properly seated when the brazing alloy melts. With accuracy of seating thus assured, the only operations requiring manual attention are loading, fluxing and braze alloy preplacement, which can be easily handled by two operators. Unit requires only 7 x 8 ft of floor space.

Sales Corp of America, Dresher, Penna

MORE DATA? Circle 83, inside back cover

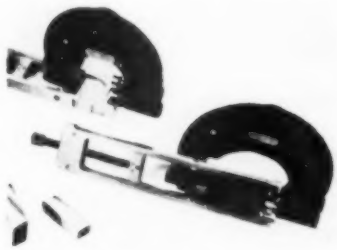


Hopper Feed Hobbing Machine Cuts Pinions Automatically

Mikron 119 Pinion Cutting Machine (German) is offered as a fully automatic hopper and magazine feed hobbing machine for cutting pinions of AGMA Class 2 accuracy with a tooth surface finish of 32 microinches. Capacity is 15/32 in. diameter by 19/32 in. length. The machine requires no skilled help and only occasional refilling of the hopper with pinion blanks is necessary.

Distributed by Russell, Holbrook and Henderson, Inc, 292 Madison Ave, NY 17, NY

MORE DATA? Circle 84, inside back cover



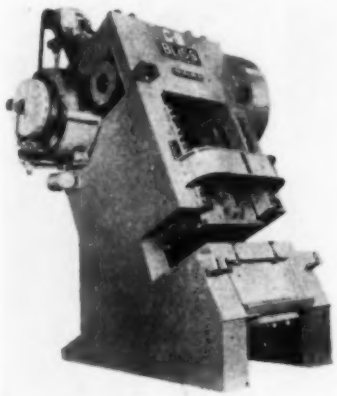
Gage Blocks Available For Setting Snap Gages

Generatrix-Blocks (Swedish) can be used with standard gage blocks in a special holder to set snap gages without using cylindrical reference discs. One measuring surface is flat and the opposite is cylindrical with the axis parallel to the flat measuring surface and lying in a diagonal plane at right angle to it. When wrung to a gage block combination, a setting master with line contact is obtained, in the same way as when using a disc.

With four Generatrix-Blocks, two setting masters for maximum and minimum dimenisons of the snap gage can be made by using gage blocks. Out of parallel measuring surfaces of the snap gage are revealed. Generatrix-Blocks are available in sizes of 0.20 in. for building setting masters from ½ in. to 12 in.

C E Johansson Gage Co, Dearborn 1, Mich

MORE DATA? Circle 85, inside back cover



PERMANENTLY INCLINED GAP FRAME PRESS of 350 ton capacity provides the convenience of a C-frame for handling large, awkward-shaped parts. Press is suited to heavy-duty auto contract work. Continuous trip operation at 40 strokes per min or single trip operation at 12 spm is possible. A heavy, cam actuated knockout and a motor-driven slide adjustment are provided. Specifications: bed area 45 x 44 in., ram area 45 x 35 in., depth of throat 12½ in. Model SGI-350—*E W Bliss Co, Canton, Ohio*

MORE DATA? Circle 86, inside back cover

Redesigned Gearheads Increase Range of Smaller Zero-Max Drives

Design improvement uses double spur gears to increase speed or torque. Newly shaped housing pro-

HAMMER DOWN PRODUCTION COSTS WITH ALCOA ALUMINUM RIVETS

When you fasten parts made of aluminum with Alcoa® Aluminum rivets, you gain three important advantages. You improve the quality and appearance of your product, reduce material cost and speed up production for added savings. Economical, easy to work with, Alcoa Aluminum rivets seat and fasten quickly and are correctly tempered for the specific job at hand.

Alcoa Aluminum rivets are produced with straight or chamfered shanks. Their bright, flawless finish adds extra selling power to aluminum products. Galvanic corrosion and staining become problems of the past.

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Your Alcoa Distributor, listed in the Yellow Pages of your phone book, carries complete stocks of all standard types and sizes . . . delivers quickly, anywhere, any time. For free samples and additional facts, mail the coupon today.

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CIRCLE 264 READER SERVICE CARD

vides for more rigid mounting.

Gearheads increase the range of the smaller Z-M stepless variable speed drives from 120 to 150 in.-lbs of torque with variable speeds of 0-80 to 0-2000 rpm. Available gearhead ratios are 1 to 2, 3, 4, and 5 and from 5, 4, 3, 2 to 1 but torque is constant and speed is infinitely variable. New design provides quieter operation and permits location of control at front of rectangular case. Output shaft is now located in the center of the unit on all models whether used for increasing or reducing speeds.

Zero-Max Co, 1900 Lyndale Ave S, Minneapolis 5, Minn

MORE DATA? Circle 87, inside back cover

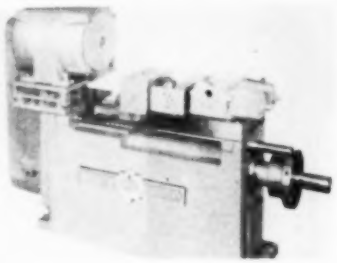
Lightweight Air-Powered Riveter Has Shock-Absorber Qualities

Tool is designed to cover a wide range of light riveting, chipping, scaling, calking, and nail-driving. Rubber-bonded nozzle reduces the high-frequency vibration formerly transmitted from tool to operator, and dampens the sound amplifying effect of the hollow barrel. Built-in power regulator assures proper power and speed for each class of work. Sleeve-type valve, through which the piston passes, permits a longer piston stroke in proportion to the barrel length, resulting in a short over-all length with greater power.

Available in four power sizes with choice of seven throttle handles. Capacities range from ⅛ to ¼-in.-dia cold rivets (aluminum, dural, or soft iron).

Ingersoll-Rand Co, 11 Broadway, New York 4, NY

MORE DATA? Circle 88, inside back cover



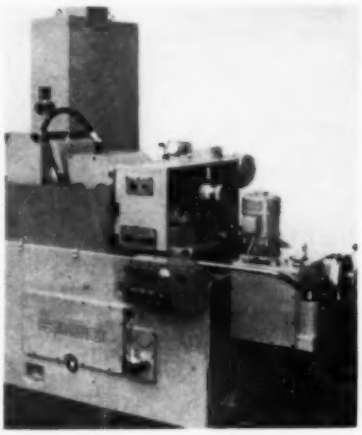
8-in. Stroke Hydraulic Quill Unit Introduced by Rehnberg-Jacobson

Self-contained unit adapted to the building block idea for machine tools incorporates standard hydraulic valves, pump, and switches for power and control of feeds.

Thrust is 500 lbs at 750 psi (theoretical); feed rate is 0.2 to 40 ipm at 500 psi; rapid approach and return rate is 240 ipm (theoretical). Spindle speed range is 600-2500 rpm with a 3 or 5-hp motor at 1800 rpm; 250-2500 rpm with a 3-hp 1200 rpm motor. Drilling capacity in cast iron is 1¼ in.; in steel 1 in.

Rehnberg-Jacobson Mfg Co, 2135 Kishwaukee St, Rockford, Ill

MORE DATA? Circle 89, inside back cover



German Centerless Grinders Offered in Four Models

Herminghausen centerless grinders (German) are now available in four sizes, the latest edition being the SR3 with a wheel measuring 15¾ in. dia by 7 in. face width.

Features of the line include: Precifilm plain bearings DBP for the grinding and regulating wheel spindles to insure free running with minimum clearance; infinitely variable regulating wheel speed; roller guidance of the regulating wheel slide which can be displaced with an accuracy of 0.00004 in. and in increments of 0.00004 in.; swivelling mounting bracket for precision adjustment of the grinding throat.

Ball bearing races ground on these machines were out-of-round only 0.2 to 0.3 microns, during high output production grinding.

Imported by Eric R. Bachman Co, Inc, 27-11 41st Ave, LIC 1, NY

MORE DATA? Circle 91, inside back cover

Plastic-Coated Steel Available As 48-Inch Wide Coiled Strip

Coiled strip steel, coated with a tough polyester plastic fused to the metal, is available in widths up to 48 in. from National Steel's Enamelstrip Corp. Tradenamed Miracoil, the material can be produced in any color and in any design that can be photographed, including wood grains, leather and marble patterns.

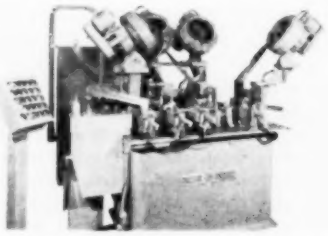
In making Miracoil, steel strip is first washed, treated, dried, and coated with an adhesive, which is pigmented with the desired color. It is then heated to expand the surface pores of the steel for deep penetration by the adhesive. Specially designed roller applicators fuse the clear plastic film, which has been printed with the desired pattern, to the adhesive-covered steel. Additional heat is applied to set the plastic permanently.

The same techniques and the same tooling can be used to fabricate Miracoil as used for regular sheet steel. Without harming the decorated surface, the material can be deep drawn, roll formed, lock seamed, sheared, crimped, bent or pierced. It is said to be highly resistant to outdoor exposure, abrasion, or staining.

According to the manufacturer, Miracoil's greatest application will be in the home appliance field.

Enamelstrip Corp, Subsidiary of National Steel Corp, Allentown, Penna

MORE DATA? Circle 90, inside back cover



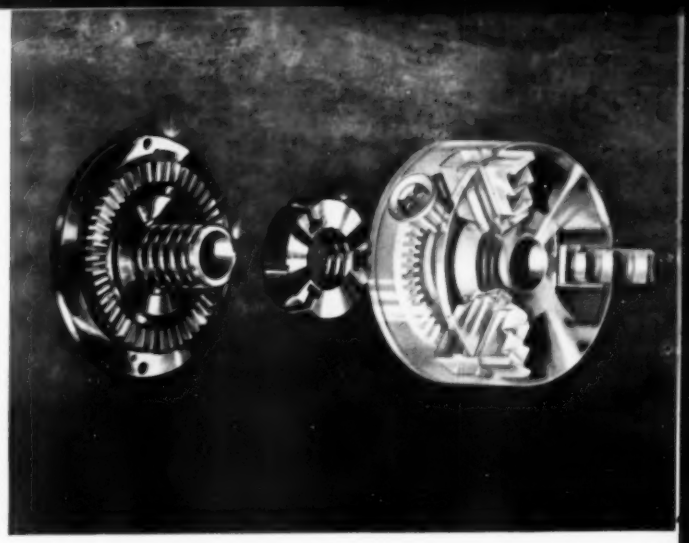
NEEDLE BEARINGS are assembled on this in-line transfer type machine 1270 that assembles 2 rows of needles, 1 spacer, and 2 washers in a transmission gear. All parts are magazine or hopper fed, and are indexed station to station by a hydraulically actuated walking beam transfer. Complete cycle is 3½ seconds — *Rehnberg-Jacobson Mfg Co, 2135 Kishwaukee St, Rockford, Ill*

MORE DATA? Circle 92, inside back cover

SKINNER ANNOUNCES

The first major chuck development in 50 years

- Accuracy—within .001 total indicator reading.
- Repeatability, without adjustment—within .0005 total indicator reading.
- Unequalled gripping power—
- No size limitation—



THE FIRST MAJOR CHUCK DEVELOPMENT IN FIFTY YEARS

Skinner engineers have developed a new chuck that combines all the desirable features of hand and power chucks. This unique chuck will handle almost any heavy-duty chucking or milling operation.

This major chuck development is a principle utilizing combination of pinion, gear plate, screw and wedge. The lug-type pinion is turned manually or by a power wrench. A pinion engages the gear plate causing the screw to move the wedge. The action of the screw on the wedge controls the chuck jaws. The force of the wedge on the jaws holds the work with tremendous power.

LOOK AT THESE CHUCK FEATURES—

Over Tightening Protection—Because the gripping force is so great a sheer pin is used to protect the work and the chuck operating parts in the event the chuck is over tightened. The sheer pin is easily replaced.

Operator Protection—Eccentric, fail-safe mechanism locks rotation if sheer pin should break.

Higher Speeds—Self-locking mechanism prevents chuck from opening under any load or centrifugal force conditions.

Center Hole—permits bar stock chucking.

Sealed Operating Mechanism—Chip plates plus top and bottom seals keep operating mechanism free of foreign matter with no problems when chuck is in horizontal position.

Lubrication Fittings—are provided for all operating mechanisms.

Heat Treated Parts—All wearing surfaces are suitably hardened for wear resistance and strength.

Jaws—Choice of types available: Serrated, tongue and groove, etc.

Sizes—10", 12", 14", 15", 18", 21", 24", 28", 32", 36", 40", 50", 60" and above.

For more information about this radically new chuck write to us at the address below.

SKINNER CHUCK

THE CREST OF QUALITY

SKINNERCHUCKS

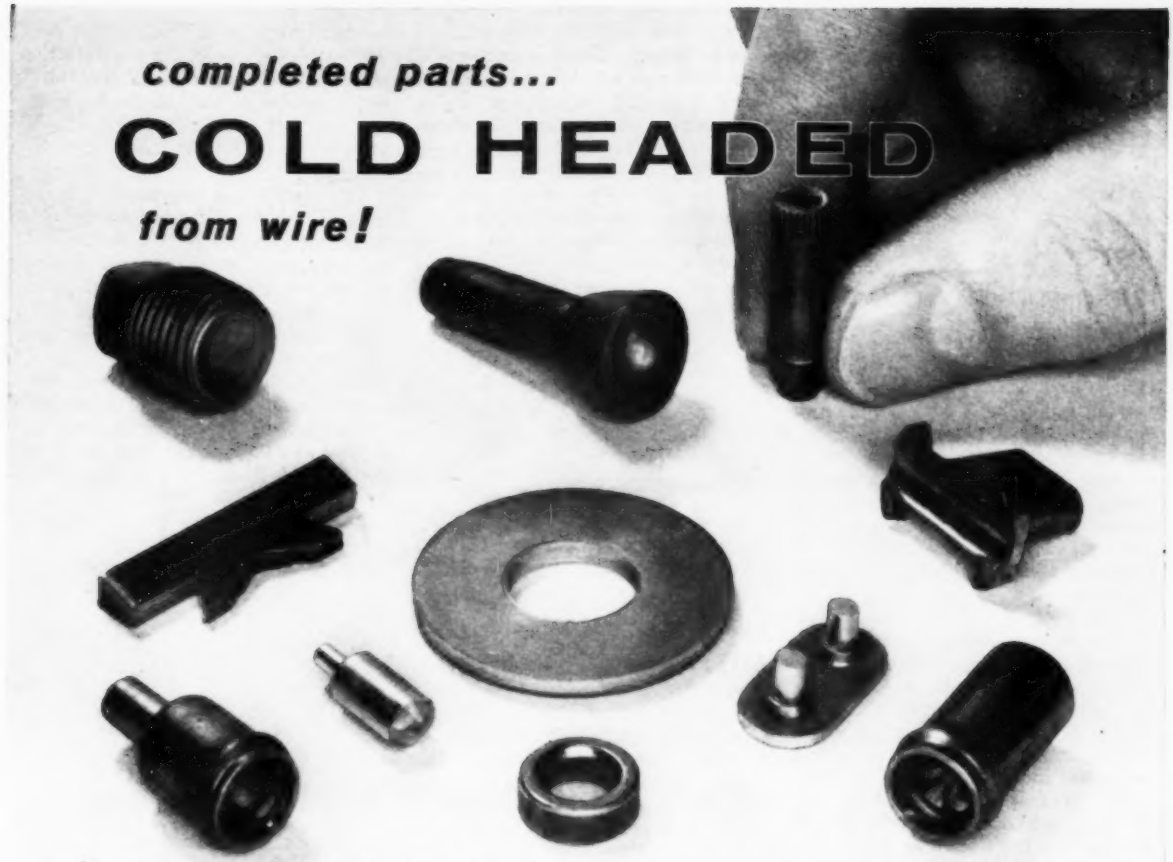
THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT

PRINTED IN U.S.A.

completed parts...

COLD HEADED

from wire!



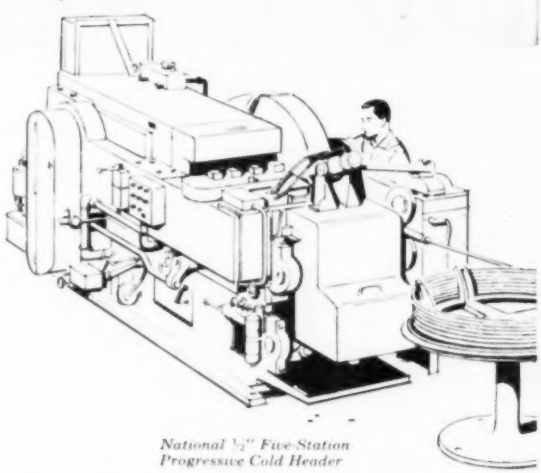
Top row, left to right: pipe plug, ball seat for push-rod end, splined square-head shaft. Middle row: commutator bar, solenoid contact, wire clamp. Bottom row: distributor cap insert, transistor case, spacer, link, distributor cap center wire insert.

All of the odd-shaped metal parts above were developed for fast, accurate production on National Cold Headers.

Complete and ready to use, these parts are made from wire, start-to-finish in one compact machine, at unbelievably high speeds with excellent die life, in most cases with no loss of material!

Production ranges from 40 parts per minute with stock of 1½" diameter up to 450 per minute in the ⅛" size. The jobs illustrated average 161 per minute.

Have you investigated Cold Heading? If you now have headers, have you considered widening your range and type of work to meet the growing requirements of metalworking?



National ½" Five-Station Progressive Cold Header

Founded 1874 — DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS

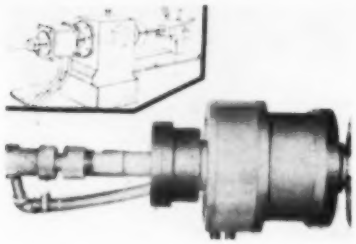
NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

HARTFORD DETROIT CHICAGO

◀ CIRCLE 266 READER SERVICE CARD

CIRCLE 267 READER SERVICE CARD



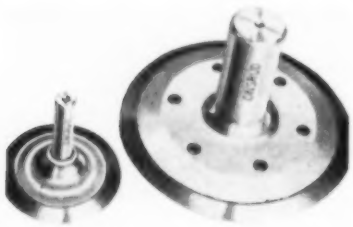
Non-Rotating Collet Actuator Opens, Closes Chucks and Collets

Unit automatically opens and closes chucks and collets and provides dependable holding power for bar or chucking work. Instead of subjecting machine spindle guide bearings to both spindle loads and gripping loads, collet clamping forces are transmitted through the actuator itself, eliminating substantial wear from the spindle bearings, resulting in longer life.

Actuator is adaptable to lathes, automatic screw machines, or machines up to 1½-in. bar capacity that utilize a collet or chuck for workpiece gripping. It is attached directly to the shaft of a machine, requires no additional fixtures. By removing the collet and inserting an adapter, a machine can be changed from collet to chuck operation without removing the actuator.

Acme Industrial Co, 200 North Laflin, Chicago 7, Ill

MORE DATA? Circle 93, inside back cover



Circular Cutter Machines Stainless Steel Honeycomb

This circular milling cutter, used for machining stainless steel honeycomb core, has a replaceable carbide ring cutter held to the shank by the retaining plate mounted to the shank with Allen screws. After the ring has been resharpened to its limit, it can be replaced with a new ring.

Cutters are available in eight cutting diameters of 1 to 8 in. In use, the 2 and 3 in. dia wheels are run from 3600 to 17,700 rpm, at feeds of 20 to 75 ipm. Depth of cut ranges from 0.015 in. min to 0.075 in. max. The 6 and 8 in. dia cutters are run at 1800, 3600, and 7200 rpm, at feeds of 20 to 75 ipm. Depth of cut ranges from 0.015 min to 0.075 in. max. The 6 and 8 in. dia cutters are run at 1800, 3600, and 7200 rpm, at feeds of 20 to 75 ipm. Depth of cut ranges from 0.015 min to 0.20 max. The resulting burr ranges from 0.003 to 0.005 in., including foil thickness.

Onsrud Cutter Mfg Co, Inc, 800 E Broadway, Libertyville, Ill

MORE DATA? Circle 94, inside back cover

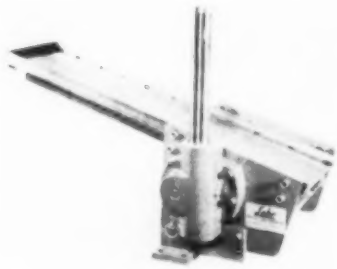
Two-Flute Carbide Tipped End Mill Available from Brown & Sharpe

Two-flute carbide-tipped end mill, recommended for all materials, is a true helix end mill designed to plunge cut and peripheral mill. This Series 600 end mill, together with the recently announced three-flute solid mills, makes available Nelco end mills up to 1 in. dia to plunge cut and peripheral mill aluminum.

According to the manufacturer, the radial hook gives freer shearing action in plunge cuts. The short length gives increased rigidity and makes for superior performance on rugged cutting operations. Additional features are greater chip clearance and added flute strength. Series 600 mill is available in sizes from $\frac{3}{8}$ to 1 in.

Cutting Tool Div, Brown & Sharpe Mfg Co, Providence 1, RI

MORE DATA? Circle 95, inside back cover



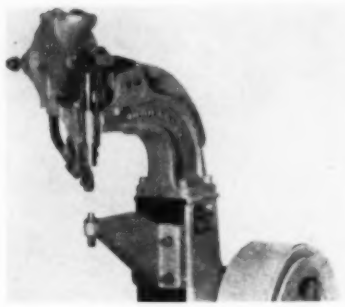
Reciprocating Unloader Controlled By Movement of Press Ram

Line of tray-type unloaders with variable stroke is available for removal of parts and blanks from mechanical presses. Tray slides underneath the die during up-stroke and receives the part or blank. During down-stroke of the press, tray emerges with the part which slides off and drops into a bin or onto a conveyor.

Two models can be furnished: rack driven, in which the full tray cycle is actuated by a rack mounted to the press ram; cable-driven, in which the tray in-stroke is energized by a steel cable attached to press ram and the out-stroke powered by an air cylinder. Tray drive mechanisms are interchangeable. Change gears are available to vary the tray stroke from 10 to 20 in. on small models with up to 36-in. trays, and from 12 to 30 in. on large units having up to 72-in. trays.

Lahr Machine & Tool Co, 3404 Maplewood Ave, Toledo, Ohio

MORE DATA? Circle 96, inside back cover



Double-Trip Riveting Machine Has Electrical Foot Switch Control

TRS Model 81JG is designed to provide a controlled pause in the setting cycle during which the operator can accurately position the work with respect to the rivet.

Setting cycle is controlled by a double-acting electrical foot switch. When this is depressed, machine is tripped and setting mechanism moves through about $\frac{3}{8}$ of its total travel and then stops. Point of interruption is adjustable to allow for various rivet lengths and work thicknesses, and brings the rivet into aligning position. Operator releases the foot switch and machine completes its cycle to set the rivet. Total cycle time is reported to be almost as fast as for an unbroken cycle. Throat depth of the unit is 10 in.; stroke is 2 or $2\frac{3}{4}$ in. Capacity is 0.200-in. steel rivets for light setting, or 0.160-in. for heavy setting.

Tubular Rivet & Stud Co, Quincy 70, Mass

MORE DATA? Circle 97, inside back cover

AIRBORNE *TACAN* DEMANDS THAT PARTS LIKE THIS FIT PERFECTLY, EVERY TIME

. . . and here's how ITT's Standards Lab makes sure they do

This heater and cathode contact ring assembly is used with a lighthouse-type electron tube in the airborne unit of TACAN, a military and commercial aerial navigation system.

As in all TACAN components, this mating part must be readily *interchangeable* in case of component failure. So Federal Telephone and Radio Company, a Division of International Telephone and Telegraph Corporation, turned to their Standards Laboratory *before* starting production.

The heater and cathode contact ring was *optically* inspected – on a Kodak Model 30 Contour Projector. After analyzing the results, minor changes in tooling were suggested. Result: a perfectly matched part, completely concentric and interchangeable.

Whatever you're inspecting . . . Whether it's tools, gages, dies, electrical or mechanical components, the Kodak Model 30 Contour Projector provides you with a projected image that's as *free* from distortion as the science of optics will permit . . . *accuracy* across the entire face of the big, 30-inch screen. Images are sharp, high-contrast; erect and unreversed at all magnifications. Changes in magnification can be made at the flick of a switch.

More refinements . . . You also get efficient head-on surface illumination and a full 16" throat clearance between collimator lens and front mirror. This clearance is constant at all magnifications, permits staging of large parts without repositioning.

The many other advanced refinements, extreme optical stability, and rugged construction of the Model 30 Kodak Contour Projector make it a leading choice for large-screen precision micrometry or routine gaging.

Cut inspection costs . . . Along with accuracy, optical gaging with Kodak Contour Projectors offers you savings in gage costs, increased inspection rates, and the economies that result from a minimum of operator training. You can use optical gaging almost anywhere in your plant . . . receiving, assembly, production, inspection, toolroom. There are 6 Kodak Contour Projectors to choose from, one matched to your inspection needs. Get all the facts by writing for our detailed catalog.

At the ITT Standards Laboratory, the Kodak Model 30 Contour Projector provides the accuracy needed for testing and servicing master mechanical and electrical measuring devices.

Special Products Sales

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

PERFECTION worm gear SPEED REDUCERS

available in ratios of 5 to 1 to 60 to 1

Perfection Worm Gear Speed Reducers by American Stock Gear are available in 9 complete series with ratios ranging from 5 to 1 to 60 to 1 for input revolutions ranging from 300 per minute to 1800 per minute. Speed Reducers are furnished in horizontal right angle drive with worm in either top or bottom position and are also furnished in vertical right angle drive. Integral worm and shaft is made of selected quality, case hardened alloy steel. Threads are precision ground and accurately mated with worm gear. Shafts are mounted in Timken anti-friction roller bearings. Heavy rigid cast-iron housings . . . easily accessible oil filling level and drain plugs are provided for oil reservoir. Oil seals are of selected cirvis leather which assures maximum sealing effect. Available through your nearest American Stock Gear Distributor.

Write for new 16 page catalog covering the complete PERFECTION Speed Reducer line.

AMERICAN STOCK GEAR DIVISION
PERFECTION GEAR COMPANY • HARVEY, ILLINOIS, U.S.A.

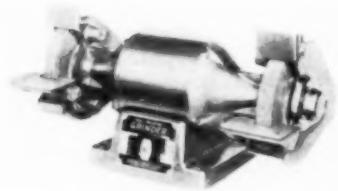
Air-Operated Marking Tool Engraves Any Type of Material

Thor No. 116 air pen, designed for engraving parts numbers on aircraft and missile components and for marking jigs, tools, and fixtures in general manufacturing operations, can be adapted to any type of material by adjusting the speed of the blow. Tool's carbide cutting tip is held in a collet for easy removal.

Unit weighs 9 oz, is $7\frac{3}{4}$ in. long, has an 11/16-in.-dia barrel. It has a diaphragm-type piston with less than 1/16-in. max stroke. Thumb screw air regulator, furnished as equipment with the pen, provides the adjustments for proper frequency of blow, producing desired depth of cut in various kinds of hardened metals. Slide-type throttle valve in tool head can be locked in open position for long periods of writing. Price of the pen, with air regulator, 8 ft of 3/16-in. air hose, and pipe thread fittings, is $60.

Thor Power Tool Co. 175 N State St, Aurora, Ill

MORE DATA? Circle 98, inside back cover

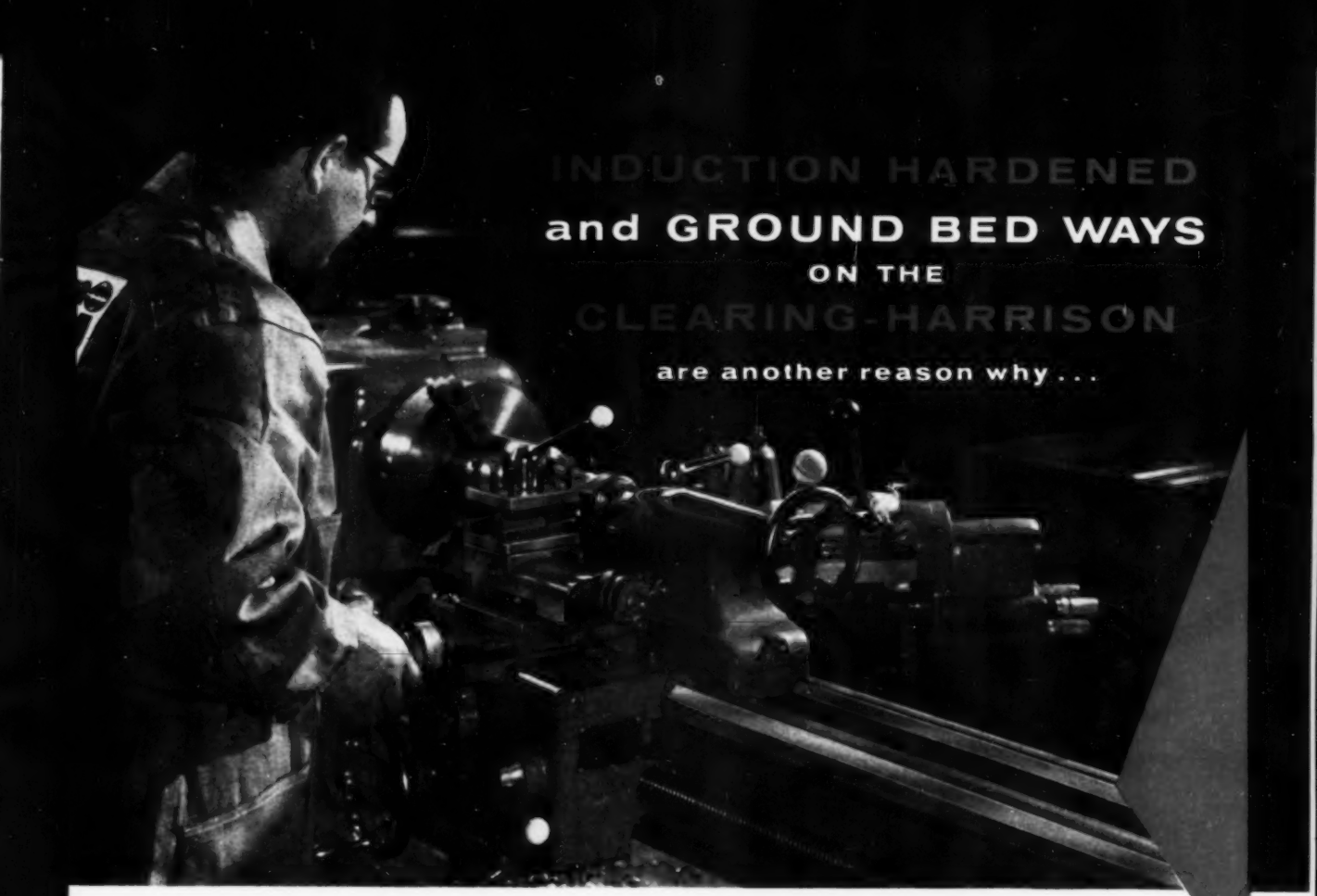


Porter-Cable Bench Grinders Offered in New Models

Model 166 is a $\frac{1}{4}$-hp standard-duty unit designed for buffing, grinding, and brushing jobs, intermittent duty. It takes 6 x $\frac{5}{8}$-in. wheels with $\frac{1}{2}$-in. bore; weight is 24 lbs.

Heavy-duty models are designed for continuous use. Model 546 is a 1/3-hp grinder taking 6 x $\frac{3}{4}$-in. wheels with $\frac{1}{2}$-in. bore. Model 547 is a $\frac{1}{2}$-hp machine taking 7 x 1-in. wheels with a $\frac{5}{8}$-in. bore. Model 550 with 1 hp uses 10 x 1-in. wheels

(continued on p204)



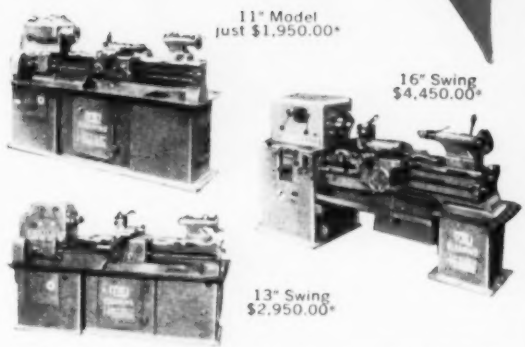
You get more . . . far more . . . for your money in a Clearing-Harrison Lathe

Users are amazed at the many plus features built into Clearing-Harrison lathes. The pure craftsmanship in this line of lathes can normally be found only in unusually expensive equipment. Yet the price of these lathes is low—a factor made possible only because we have the world's most modern equipment for producing lathes. For example, Delapina induction hardening and grinding equipment—the world's finest—is used to turn out precision, highest quality bed ways economically and quickly. These hardened ways mean longer life, less "down time", and lower maintenance.

And there's more! Taper roller bearings in the spindle; precision heat treated gears; and an all geared headstock.

Each lathe is available with or without a removable insert in the bed that increases the swing. For example, the 13" size increases to 20½".

Just check the prices at right. Then check the Clearing-Harrison line. You'll be surprised, too—pleasantly surprised. Write Clearing for the name of your nearest dealer.



*Base Price F.O.B. Chicago, Los Angeles and New York. Also available with factory built copying attachments.

Coast to Coast Service Facilities

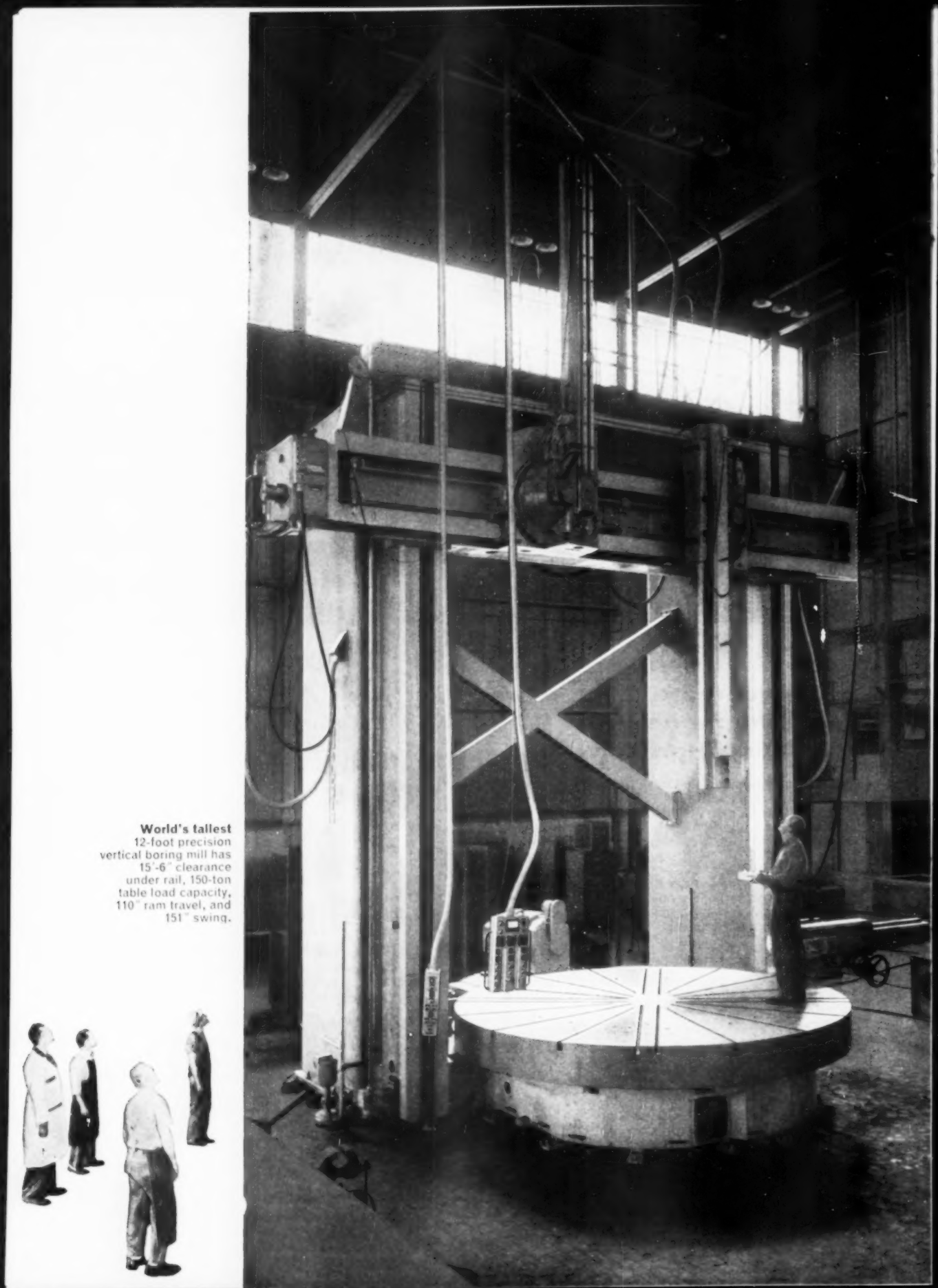
Clearing's nationwide facilities assure you of prompt service always. Replacement parts and accessories are stocked at Clearing and are available through all three plants, at all service centers and through all Clearing dealers.

USI **Clearing**

DIVISION OF U. S. INDUSTRIES, INC.

6499 W. 65th St. • Chicago 38, Illinois • Plants in Chicago, Hamilton, Ohio, Los Angeles

CIRCLE 270 READER SERVICE CARD

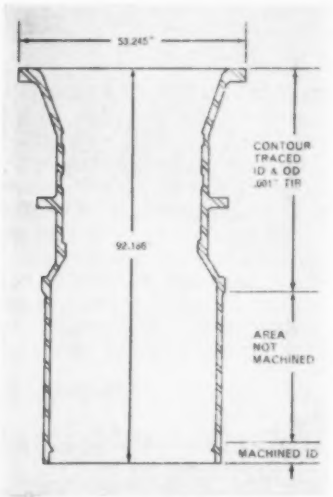


World's tallest
12-foot precision vertical boring mill has 15'-6" clearance under rail, 150-ton table load capacity, 110" ram travel, and 151" swing.

Machining big work to small part accuracies

No piecepart is too heavy or too high to make accuracy a problem on a G&L vertical boring mill.

Precision machining of big atomic reactor vessels at the R. H. Freitag Corporation, division of Alloy Manufacturing Corporation, provides a good example of the capabilities of these machines. Parts are Meehanite castings which are first machined undersize, then clad with 347 stainless and carbide-machined to final size and finish. Diameter tolerances of ± .001" with .003" TIR* on contour are required. Freitag is holding .001" TIR on parts 92" high and will be able to machine well within the precision required on parts which will require the full 186" under-the-rail clearance on the machine illustrated.



Accuracy of contour 92" above table held to .001" TIR by G&L 12-foot vertical boring mill with electric tracer attachment.

All G&L vertical boring mills are designed to deliver precision accuracies regardless of the size of the workpiece. Antifriction roller bearing table tracks are standard. A preloaded, tapered center roller bearing eliminates table tilt regardless of size or weight of workpiece. A double-walled, heavily ribbed unit bed-and-transmission assures a level, smooth-running table.

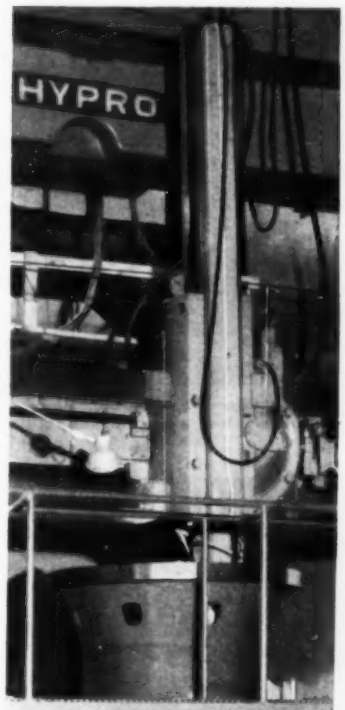
These design features result in low friction, low heat build-up, and uniform heat dissipation so that any size workload can be run *continuously at any speed* without loss of accuracy.

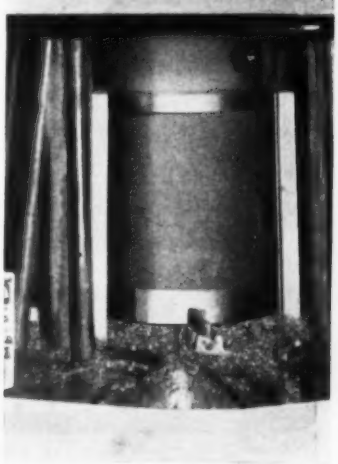
Massive ribbed box-type head, rail, and housing construction match the bed and table design to assure a machine with deflection-free rigidity under the most severe operating conditions.

For complete details on the *high-accuracy, heavy-capacity* boring mills from 54" to 20', call your G&L distributor or write to GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wisconsin.

*Total indicator runout.

Tracer machining 92" high atomic energy vessel to accuracies of .001" at the R. H. Freitag Manufacturing Corporation, division of Alloy Manufacturing Corporation, subsidiary of Salem-Brosius, Inc., Pittsburgh.





GIDDINGS & LEWIS

Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.

CIRCLE 272 READER SERVICE CARD

HOW B. Jahn

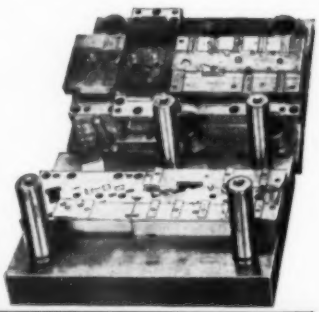
PROGRESSIVE DIES INSURE

MASS PRODUCTION PRECISION & PROFITS

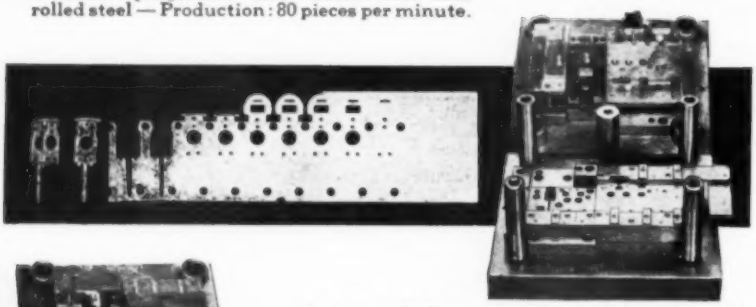
3 Cylinder Lock Parts Produced with Speed and Economy!

The ingenuity and precision designed into these B. Jahn Progressive Dies pays off in speed, economy and precision for millions of mass produced components.

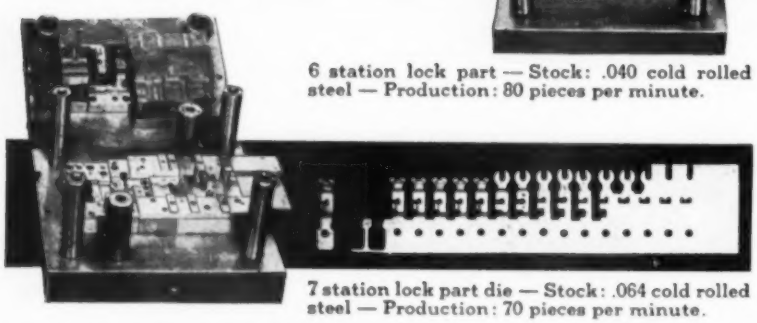
In addition to eliminating many costly production operations, the parts produced make up interchangeable precision cylinder lock assemblies, mass produced for maximum service with economy. B. Jahn Dies may be the Key to your product profit problems.



8 station progressive die — Stock: .040 cold rolled steel — Production: 80 pieces per minute.



6 station lock part — Stock: .040 cold rolled steel — Production: 80 pieces per minute.



7 station lock part die — Stock: .064 cold rolled steel — Production: 70 pieces per minute.

B. Jahn

Send for B. Jahn Brochure Today—

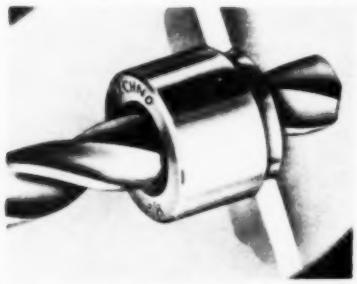
THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

CIRCLE 273 READER SERVICE CARD

with ¾-in. bore. Heavy-duty grinders have all ball-bearing construction, improved spark breakers, max wheel guard protection, large dust chutes, and wide base with rubber mounting cleats. New U-shaped toolrests are fully adjustable and may be tilted from 0° to 60° without loss of wheel clearance. Standard equipment includes ac induction motor, one 5-grit wheel, one medium-grit wheel, and toolrests.

Porter-Cable Machine Co, 105 Seneca St, Syracuse 4, NY

MORE DATA? Circle 99, inside back cover



Flar-A-Lock Drill Bushing Offered in Two New Grip Sizes

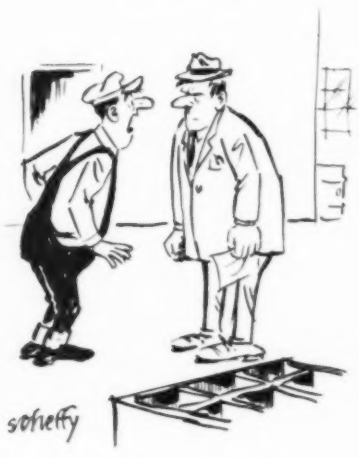
Bushing is now available in two additional grip sizes, C and D, for installation in metal tooling plate thicknesses of 3/16 and ¼ in. respectively. These supplement the existing A and B grips for use with 1/16 and ⅛-in. thickness material.

Flar-A-Lock is selectively heat treated on all wearing surfaces and is securely and concentrically installed with a hammer and hand flaring tool.

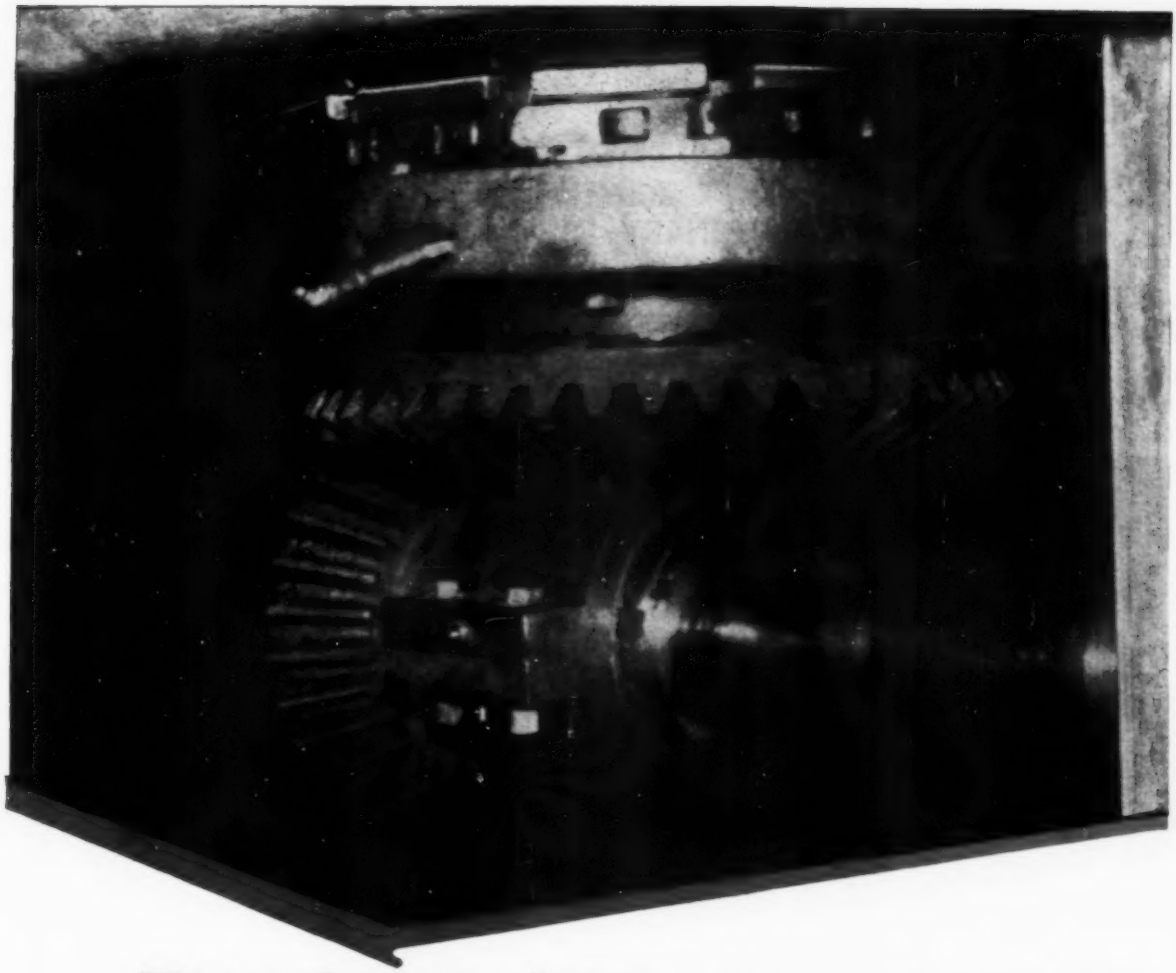
Techno-Products Corp, 407 Baily Rd, Yeadon, Penna

MORE DATA? Circle 100, inside back cover

(continued on p208)



"But you can't fire me—it'll break up our car pool!"



a Bearings, Inc. conversion with a 2 year record of no lost production, reduced maintenance . . . and a 30% Power Savings!

Over two years ago our engineers converted this main drive gear from a babbitt bearing to a ball bearing unit on a machine at Highland Park Manufacturing Company, Charlotte, North Carolina. Performance of this conversion, according to company engineers, has been outstanding! The housing for the bearings as well as the gear hub was produced by the customer in their own machine shop.

Prior to conversion, machine downtime was excessive because the babbitt had to be repoured every three or four months. A plus saving was in the reduction of power required to operate the machine. Highland Park Manufacturing Company officials now find power consumption is 30% less!

If your older equipment can be modernized with anti-friction bearings — our engineers can show you how. If you need bearings for any purpose, our stock carrying branches can supply you. We are *authorized* distributors of most nationally known makes of bearings. We and the makers guarantee every bearing we supply — Call the branch nearest you now!

Providing bearing service in the North

BEARINGS, INC.

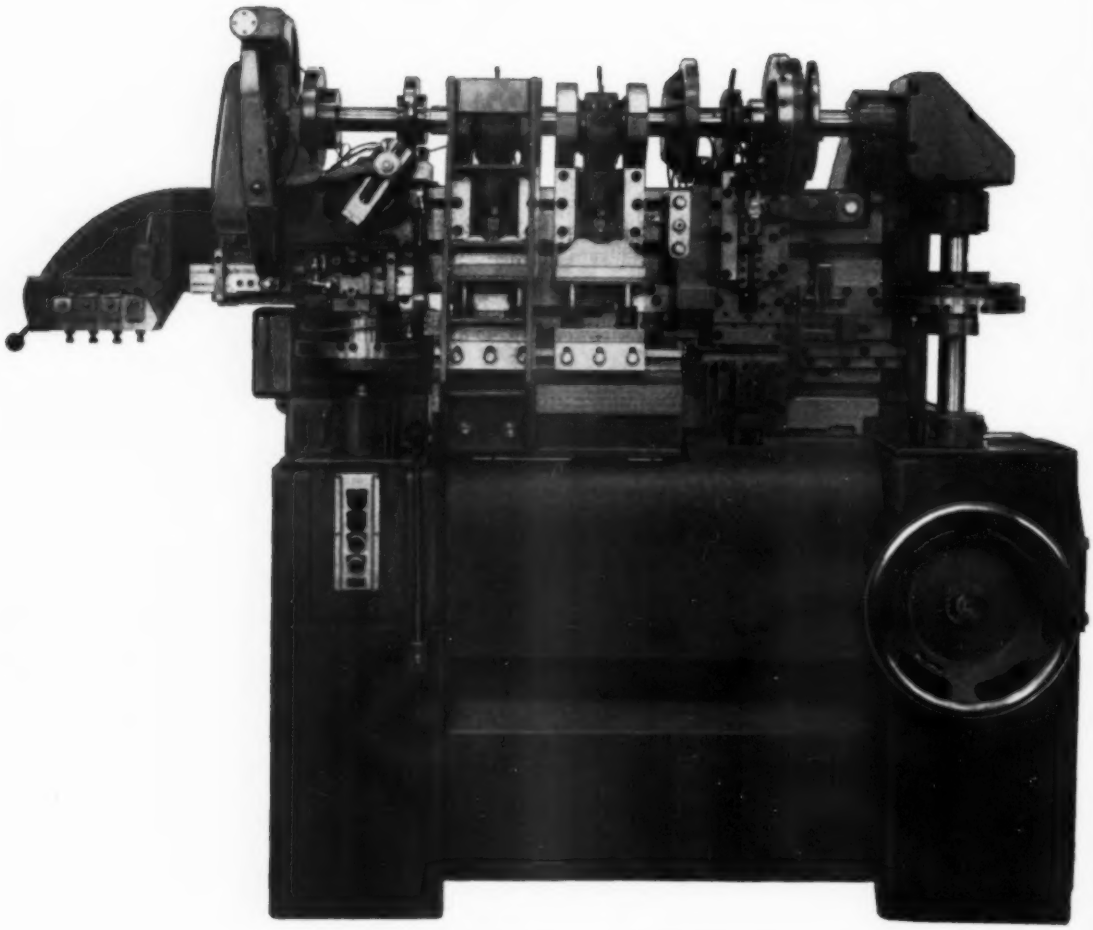
OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Toledo • Youngstown • Zanesville
INDIANA: Ft. Wayne • Indianapolis • Muncie • Terre Haute • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden
NEW YORK: Belanrol Corp., Buffalo • Niagara Falls • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington

and in the South

DIXIE BEARINGS, INC.

FLORIDA: Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge • New Orleans
N. CAROLINA: Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville • Nashville
VIRGINIA: Richmond

ON ITS FIRST PRODUCTION JOB THIS REVOLUTIONARY MACHINE...



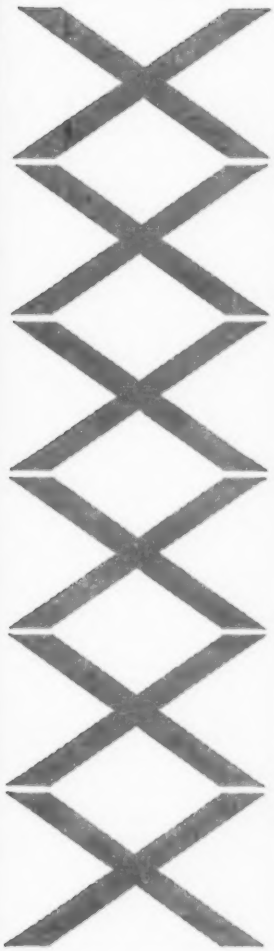
It's the sensational Torrington **Verti-Slide**, a most important **new** production tool. This amazing new vertical four-slide machine promises a genuine revolution in the **high-speed, high-precision, low-cost production** of just about everything in strip or wire that is now being produced on progressively tooled forming presses or conventional four-slide machines. Write or call today for complete technical data—or a Torrington sales engineer.

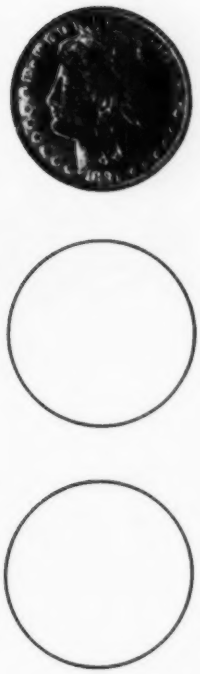
THE TORRINGTON MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO

DID THE WORK OF SIX PROGRESSIVELY TOOLED FORMING PRESSES...

AT FOUR TIMES THE SPEED...

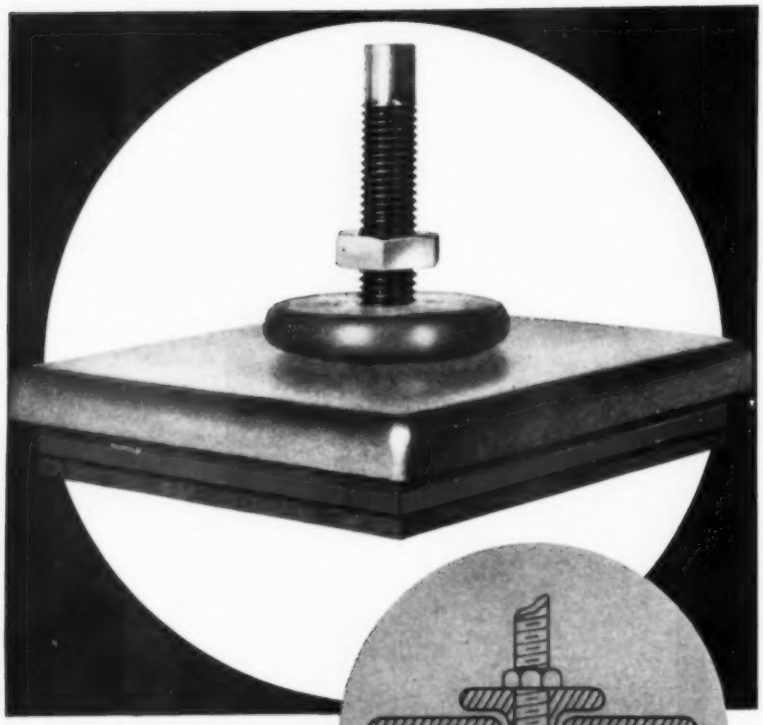
AND ONE-THIRD THE COST!





◀ CIRCLE 275 READER SERVICE CARD

CIRCLE 276 READER SERVICE CARD



UNISORB LEVEL-RITE Machinery Mounting

The new Level-Rite has been developed as a universal self-contained leveling mount for all types of machinery. It combines the features of Unisorb with the advantages of a rugged, easy-to-use device for precise leveling of machines. Machines are completely "mobilized." One unit required for each machine leg, with load ratings to 7500 lbs. per unit.

Exclusive Screw-Post Design . . . Machine legs mounted on special leveling screw and plate assembly, which rests in all-steel base plate. Machine is quickly and easily leveled by simply rotating the square top of the leveling screw, then securing lock nut. Machines stay level.

No bolts, lag screws or cement . . . Level-Rite eliminates all need for anchor bolts or screws. Designed so compression provides positive hold, no "walking" or creeping under the toughest side loads. Machines can be moved whenever and wherever required.

Superior Unisorb Vibration Dampener . . . Industry's most efficient isolator reduces transmitted vibration up to 85%. Contributes to more productive machine hours, lower building maintenance, higher machine speeds. Unisorb will not deteriorate, is resilient, and is impervious to cutting fluids and cleaning compounds.

UNISORB 200 SOUTH STREET BOSTON 11, MASS.

Want more information? Send for Unisorb Consolidated Facts Bulletin!

Division of The FELTERS CO.
Please send me a Unisorb Sample and Consolidated Facts Bulletin.

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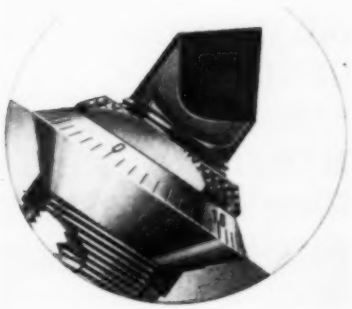


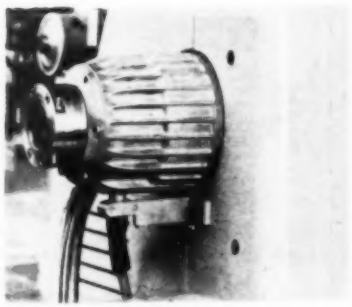
Microbore Offers Titanium Carbide and Ceramic Tipped Tooling

New Microbore tools which are said to provide feeds and speeds impossible with any other type of cutting edges are also reported to produce excellent surface finish, in some instances comparable to ground finish.

Both the titanium carbide and ceramic tipped tools are cone relief ground to gage room accuracy. Cone relief grinding provides uniform clearance around the profile of the cutting edges, resulting in maximum tool life. Because of the high rigidity of the basic Microbore design, which consists of a double cone bearing and axial locking force, there is a minimum of overhang between cutting tip and cone seat assembly, thus providing the rigidity necessary for maximum benefits from the new cutting materials.

DeVlieg Machine Co. Microbore Division, Fair St, Royal Oak, Mich

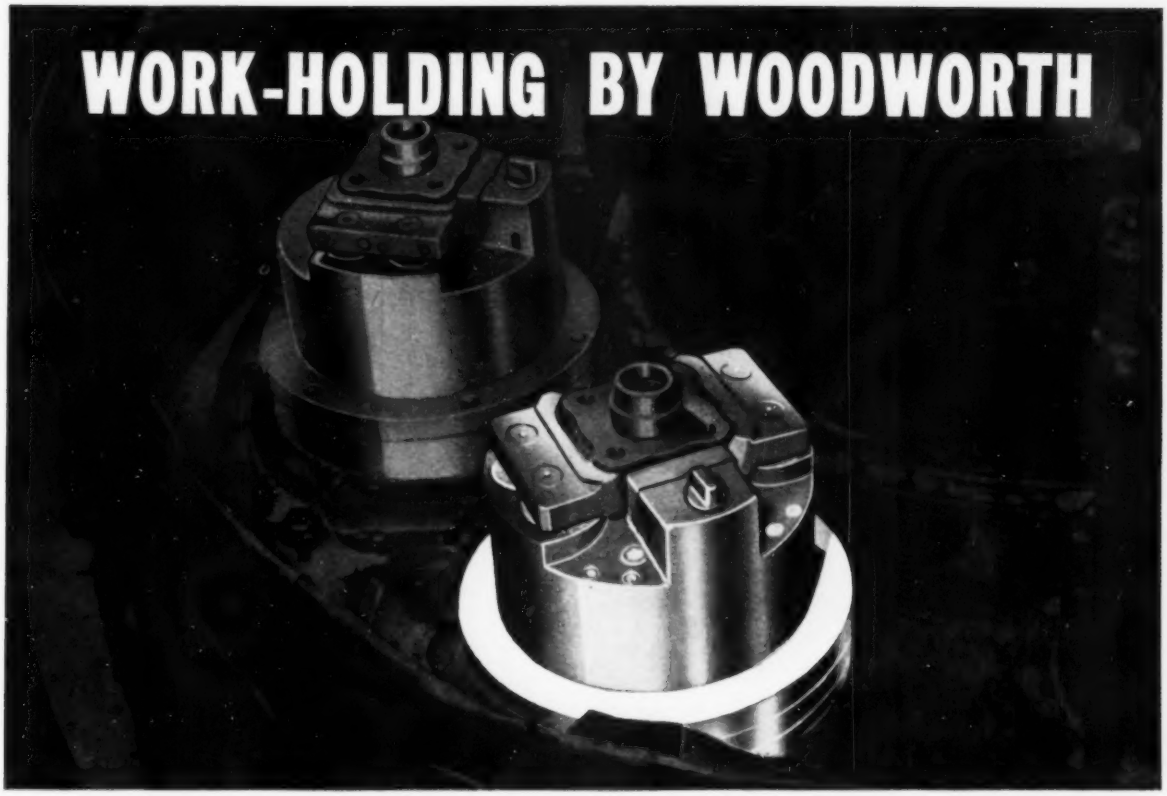
MORE DATA? Circle 101, inside back cover



Hydraulic Chuck Actuator Operates at up to 500 psi

Gamet (French) actuator is a rotating hydraulic cylinder used to operate power chucks, collets, and other holding devices on machine tools. Unit, which can be operated at pressures up to 500 psi, provides large thrust capacity from a small cylinder. A center hole (up to 3 in. ID) permits user to chuck bar stock in a power chuck. The four standard

WORK-HOLDING BY WOODWORTH



WOODWORTH'S *New* "BALL-LOK" CHUCK MEETS HEAVY PRODUCTION DEMANDS AT KELSEY-HAYES

KELSEY-HAYES COMPANY in Detroit, one of industry's major automotive parts suppliers, each day produces hundreds of wheel hubs using N. A. Woodworth Company's revolutionary new **"BALL-LOK"** Chucks. An actual on-the-job photograph (above) shows an application in Kelsey-Hayes' hub and drum machining department where 4 Bullard Multi-Matic machines are equipped with 32 Woodworth **"BALL-LOK"** Chucks. Here rough castings of the wheel hub and flange are bored, turned, faced, reamed and drilled.

The Woodworth "BALL-LOK" Heavy Duty Power Chuck presents an entirely new principle in chucking. The jaws are actuated through a ball joint which minimizes friction losses and provides a pull-back action to the jaws.

- The "BALL-LOK" has tremendous gripping force — a 5 to 1 ratio on the drawbar pull.
- Completely sealed and lubricated jaw actuating mechanism eliminates wear problems inherent in all other power chucks.
- T Slots, where master jaws in other designs wear out, are completely eliminated in the "BALL-LOK".
- Both "Draw-Bar" and air operated "BALL-LOK" Chucks are available.

MAINTENANCE SAVINGS WILL PAY FOR YOUR WOODWORTH "BALL-LOK" CHUCK

WRITE FOR COMPLETE DETAILS ON N. A. WOODWORTH'S NEW "BALL-LOK" POWER CHUCK. A WOODWORTH REPRESENTATIVE IN YOUR AREA CAN IMMEDIATELY DISCUSS AND ANALYZE YOUR PARTICULAR WORK-HOLDING PROBLEM.

When You Buy, Specify

ACCURACY YOU CAN TRUST

WOODWORTH

1300 EAST NINE MILE ROAD · DETROIT 20, MICHIGAN

FREE TRIAL OFFER

Discover what customized MASTER POWER AIR TOOLS can do to increase production

Test Master Power Air Tools without obligation. They are fitted individually to your job, precision-built and can frequently be serviced on the spot. Men who use Master Power tools like their speed and heft.

Discover how Master Power can step up production and reduce down-time. Performance on specific applications in your plant is proof of their power, versatility and quality. Mail the coupon today for a 10-day tool test . . . at no cost and without any obligation.

Master Power

Look under TOOLS-PNEUMATIC HOISTS-PNEUMATIC

CORPORATION • Bedford, Ohio

A Black & Decker subsidiary

sizes provide a thrust of up to 13,000 lbs; thrust capacity of up to 23,000 lbs can be made on special orders.

Hole in the actuator can be used to hold bar stock or long work pieces, to introduce coolant to the ID of the work, to permit drilling or other machining of the back of the work, or to house a mechanism for automatic ejection of the finished work.

Distributed by PowerGrip, Inc, Rockfall, Conn

MORE DATA? Circle 102, inside back cover

Portable Sand Blaster Has Pistol-Grip Blast Gun

Model B Sandy Jet is equiped with a newly designed pistol-grip gun that simplifies cleaning hard-to-reach areas. Unit can use all types of abrasives with three sizes of job-suited nozzles. Standard equipment includes an operator's hood, face shield, and two extra nozzles. Price is $39.95.

ALC Co, RD 5, Box 40, Medina, Ohio

MORE DATA? Circle 103, inside back cover

"I hope you don't still have my micrometer in your back pocket."

Light-Duty Turbine Grinder Operates at 70,000 rpm

Desoutter (English) air grinder, specially designed for tool and die makers requiring a unit for intricate hand work, grinds, deburrs, cuts, polishes, and engraves.

The 12½-oz grinder runs cool, blowing chips away from work. It is furnished in a wooden case with six mounted grinding wheels, chuck spanners, head spanner, 10 ft of ⅜-in. hose with two connectors, jet plates and a dressing stone. It is guaranteed for a year and priced at $49.50.

Distributed by Newage Industries, 222 York Rd, Jenkintown, Penna

MORE DATA? Circle 104, inside back cover

Ultra-Fine Hole Driller Offered For Mill, Drill Press, or Lathe

Hunter-Stanley small hole driller incorporates an Albrecht micrometer chuck or the small Jacobs chuck. Accuracy of 0.0002 is claimed. Unit has finger-tip control which enables operator to feel his way, thus minimizing breakage of many small drills.

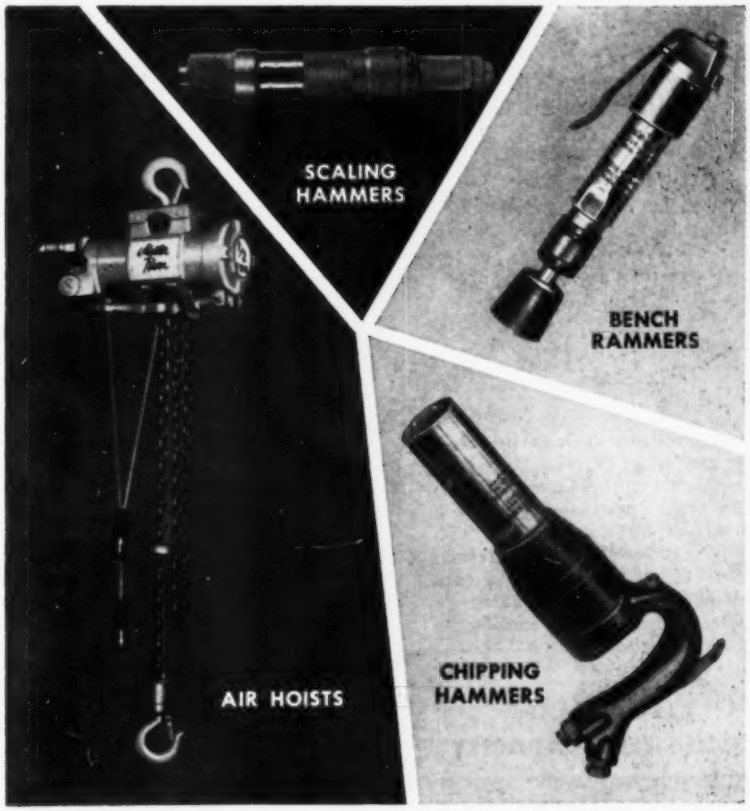
Hunter Tool, PO Box 564, Whittier, Calif

MORE DATA? Circle 105, inside back cover

6-in.-Capacity Air Grinders Have Increased Power, Same Weight

No. 5 Series of straight air grinders are equipped to deliver more torque to the wheel and remove more metal faster, yet remain in the 10-lb weight

10-DAY TOOL TEST



Discover how customized MASTER POWER AIR TOOLS are custom-sold, custom-installed and custom-serviced

Sold and serviced in 49 principal cities in the United States and Canada.

MAIL COUPON TODAY FOR 10-DAY FREE TRIAL

Master Power Corporation, Dept. 210, Bedford, Ohio

Gentlemen: I want to run a Master Power 10-Day Tool Test. I understand that there is no obligation.

☐ I am interested in *Impact Wrenches*
☐ I am interested in *Threaded Fastening Tools*
☐ I am interested in *Percussion Tools*
☐ I am interested in *Abrasive Tools*
☐ I am interested in *Air Hoists*

Company.....

Individual.....

Street.....City.....Zone.....State.....

In Canada: MASTER PNEUMATIC TOOLS (CANADA) LTD., REXDALE-TORONTO, ONTARIO

NOW! for the FIRST time HYDRAULIC FEED on a 10" x 16" grinder

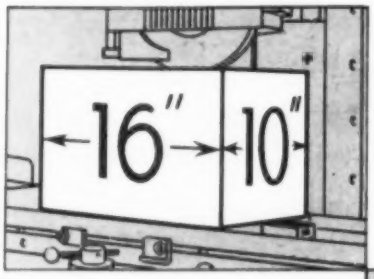
LOW COST Micro-Precision, High Speed Grinding

No. 17H Priced at only $3285.00

to give you the operating ease and high speed of hydraulic feed for little more than the cost of a hand feed grinder.

For precision surface grinding on tool room or production jobs, you can't beat the Covel No. 17H. The large grinding wheel with plenty of direct power *plus* high speed hydraulic feed and big cross-feed capacity make it a real money saver. *Grinds approximately twice as fast as with a comparable hand feed machine.*

FULL 10 INCH CROSS-FEED CAPACITY



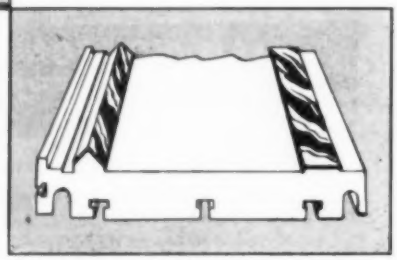
The full 10" cross-feed capacity of the Covel No. 17-H puts it in a class by itself among surface grinders in its price range. You get the extra working capacity you need for bigger jobs without paying a big premium in price!

HARDENED AND GROUND LEAD SCREWS have precision ground threads for smooth, accurate transverse and vertical feed.

PRECISION QUILL TYPE SPINDLE is grease lubricated and sealed for life. 2 HP, 1750 RPM direct drive motor.

FIRST WITH HARD CHROME TABLE WAYS

Available at extra cost for super long-lived accuracy. Hard chrome is applied direct to V and Flat table ways after hand scraping to master plate, preserving original built-in accuracy.



Micro-Precision a Covel Tradition-Since 1874

COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

Write, wire or call us TODAY. We'll gladly show you what the Covel 17H can do for you. Ask for Bulletin AM-209.

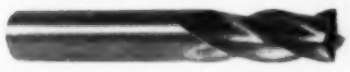
class and are only 2 lbs heavier when geared down to wire-brush speeds.

Positive safety control is assured by an over-speed control, integral with the standard governor which guards normal speed controls. Device automatically cuts the air supply to the motor whenever a governor failure or other condition causes over-speeding. Control cannot be reset until tool is disassembled. Exhaust noise of the grinders is reduced by 50%. Motor housings are insulated inside a double-wall construction, which also cools the motor.

Units are available with butterfly throttles, lever throttles, and grip throttles. Models in the series are furnished at speeds of 4500 or 6000 rpm. Special gearing sets wire-brush model speeds at 2000 rpm.

Thor Power Tool Co, 175 N State St, Aurora, Ill

MORE DATA? Circle 106, inside back cover



END MILLS, single-end HSS Hi-Lo line, are 4-flute, RH cut, RH spiral units available in six sizes from ⅛ to ½-in. end mill diameter—O K Tool Co, Milford, NH

MORE DATA? Circle 107, inside back cover

"I've got bad news, boss. I just found out that every one of our shop employees owns stock in the company that buys our scrap."

Everybody knows that

National Tool Company

makes special hobs—

But did you know

we make special carbide

tipped surface broaches...

and more special cutting tools of all kinds

than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one special tool or a complete tooling program.

National Tools Cleveland

National

TOOL CO.

Cleveland 2, Ohio

Representatives in major industrial centers

New FREE Catalog

To National Tool Co., 11200 Madison Ave., Cleveland, Ohio

Please send NEW 92 page catalog showing National Tool Company's complete line of special tools for the metal-working industry.

Name_____

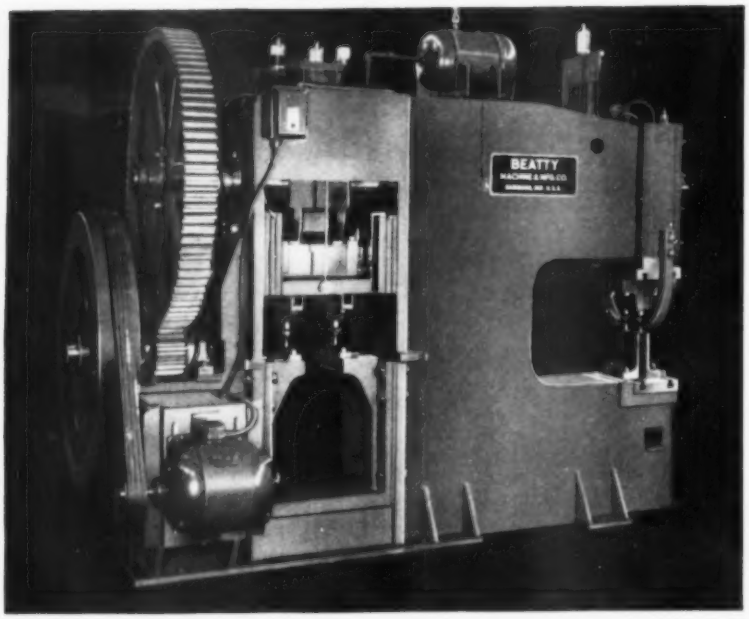
Position_____

Company_____

Address_____

City_____ Zone_____ State_____

When Will ONE Machine Do The Work of THREE?



WHEN IT'S A BEATTY DETAIL BEAM PUNCH

Here's a real cost-saver that punches I-beams in just three passes instead of the usual five, and further speeds production by eliminating the end-for-end turning of beams. Many shops require three ordinary machines to do the work which can be handled by one Beatty Detail Beam Punch. This punch not only saves floor space, but also reduces your equipment investment. High dies in the open throat portion punch webs of beams, angles, channels and plates. Punch tools in overhanging bolsters in the guillotine portion punch holes in flanges on either side of the webs of beams. Write for complete details.

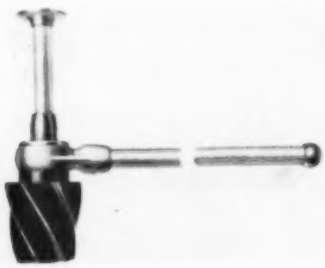
SPECIFICATIONS — No. 7 Detail Beam Punch. Capacity: 100-tons or punching 1¼" hole through 1" mild steel.
WEB PUNCH END: Face of Ram, 6" x 18" — Face of Table, 6" x 18" — Distance ram to table, stroke up, 21¾" — Length of Stroke, 13" — Depth of Throat, 30". FLANGE PUNCH END: Opening through frame, 26" — Length of stroke, 2" — Distance ram to table, stroke up, 12".

TOOL EQUIPMENT: WEB PUNCH END — One set single gag punch tools for punching plates, angles, webs of beams, channels and shapes. FLANGE PUNCH END — Two sets of single gag punch units suitable for punching flanges of beams and channel sections.

Punch units for both ends are of the drop stem type for locating the punch in proper position.

ONE OF THE BEATTY FAMILY OF METAL WORKING EQUIPMENT: Shears, Punches, Presses, Spacing Tables, Bulldozers, Stamping Trimmers

BEATTY MACHINE & MFG. CO.
948 150th St., Hammond, Indiana

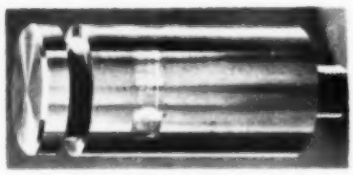


Spiral Reamer Offered for 3½ to 4-in. Pipe and Conduit

Ridgid No. 354 smooths the inside edges of pipe and conduit, eliminating slow, costly hand filing. Ratchet handle speeds work in tight quarters. Seven spiral cutting edges pare off metal, reportedly without chatter. Hand grip has large pressure plate for application of body pressure when necessary. Hollow reamer construction reduces weight; hardened tool steel cone is removable for sharpening.

Ridge Tool Co, Elyria, Ohio

MORE DATA? Circle 108, inside back cover



Taylor Liquid Spring Produces 40,000-lb Force on ¼-in. Stroke

Model 2040, using liquid compressibility, produces this amount of force in the self-contained package only 2½ in. in dia and 5 in. long. An interior shock absorber action may be added without changing the over-all dimensions, making it a combination spring and shock absorber. Shock absorbing force is available up to 60,000 lbs or 15,000 in.-lbs of energy absorption. Spring rate is 120,000 lbs per in. of deflection.

Mounting method is a 1-in.-long stud. Uses include providing a yieldable member on overload applications encountered in heavy press operations.

Taylor Devices, Inc, 188 Main St, North Tonawanda, NY

MORE DATA? Circle 109, inside back cover

Thread-cutting screws, labeled Type F and B-F, are reported to reduce pressure development by 80%. The completely formed threads on these tapping screws have sharper cutting edges and five deep flutes of continuous depth. Type F cuts a machine screw thread; Type B-F is for fastenings in thin or brittle materials; Type L is a combination thread-cutting and thread-forming screw for use in nylon.

Parker-Kalon Div, General American Transportation Corp, Clifton, NJ

MORE DATA? Circle 110, inside back cover

Line of self-locking nuts for use on new 160,000 psi short thread NAS screws and bolts is said to be 20 to 40% lighter than self-locking hex nuts currently produced for 125,000 psi AN bolts. Anchor, miniature anchor and gang channel nuts have been redesigned to the strength level of the new series of bolts.

Kaynar Mfg Co, Inc, Kaylock Div, Box 2001, Terminal Annex, Los Angeles 54, Calif

MORE DATA? Circle 111, inside back cover

Expanding collets for internal chucking are actuated by a ball-bearing lever collet closer. Model 8U-155, one-piece construction, holds a workpiece as small as ⅛ in. dia. Steps can be turned on it to suit various internal diameters. Collar can be furnished to hold accurate shoulder dimensions. Model 8U-165 makes use of interchangeable expanding collets for different sizes. Designed to take somewhat larger work than the 8U-155, and to hold exact shoulder lengths, it can be used only on lathes having the American Standard spindle nose.

Wade Tool Co, Waltham, Mass

MORE DATA? Circle 112, inside back cover

Miniature rotary positioning controls will hold loads from inch ounces to 200 inch pounds in an infinite number of positions for clockwise or counterclockwise rotation. Featuring zero backlash and low breakaway torques, the controls can be used for applications such as valve positioners, clutches, and couplings. Controls have been tested for speeds up to 3800 rpm.

Reid Controls, Reid Metal Products, Inc, 2001 N Lincoln St, Burbank, Calif

MORE DATA? Circle 113, inside back cover

PERTINENT QUESTION:

WHEN do you need the Profilometer®?

FACTUAL ANSWER:

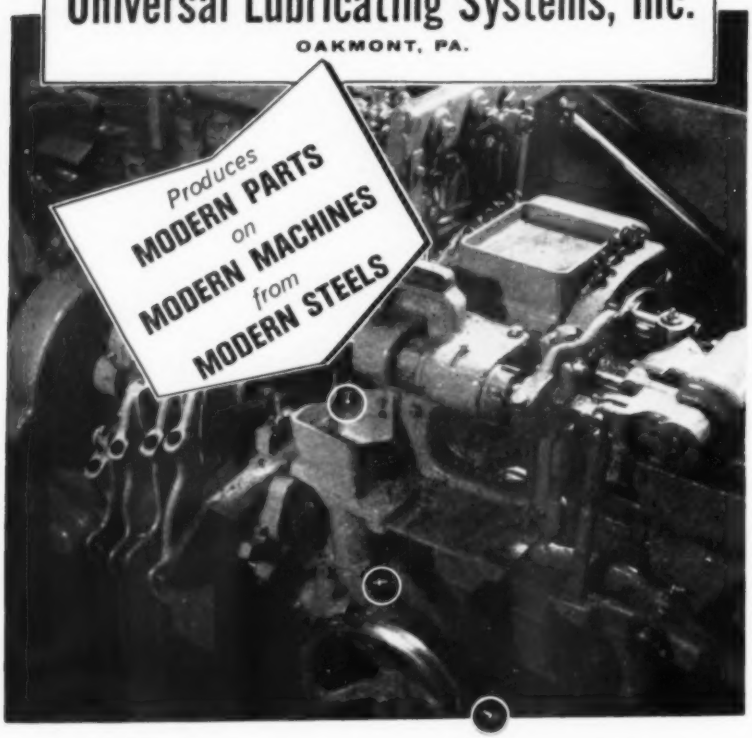
Whenever you must precisely *know* the roughness of *any* production surface — quickly, dependably, in microinches (arithmetical or rms).

FREE BULLETIN LT14 gives details — describes cost-saving applications. May we send you a copy?

MICROMETRICAL MMC MANUFACTURING COMPANY
345 S. MAIN ST. ANN ARBOR 1, MICHIGAN

Manufacturer of the PROFILOMETER®, PROFICORDER®, MICROCORDER, WAVOMETER®, ANDEROMETER®, VAROMETER, CHART VIEWER • Exclusive American Sales Agent for CENSOR Dimensional Gaging and Sorting Equipment

Universal Lubricating Systems, Inc.
OAKMONT, PA.



Their continuous use of

WYCKOFF

LEADED COLD DRAWN BARS

has definitely increased their production, extended tool life, and produced a better finish at higher machining speeds.

Why not check the possibilities of Wyckoff Leaded Steels on your requirements? They're available in AISI analyses – carbon and alloy steels.

SPECIALISTS IN COLD FINISHED STEELS EXCLUSIVELY

WYCKOFF STEEL COMPANY
GENERAL OFFICES:
Gateway Center, Pittsburgh 30, Pa.
Branch Offices in Principal Cities
Works:
Ambridge, Pa., Chicago, Ill., Newark, N. J., Putnam, Conn.

OUR CONSTANT RESEARCH PROGRAM IS YOUR BEST GUARANTEE OF QUALITY CONTROL

WYCKOFF STEEL PRODUCTS • Carbon, Alloy and Leaded Steels • Turned and Polished Shafting • Turned and Ground Shafting • Large Squares • Wide Flats up to 12¾" x 2¼" and 14" x 1¼" • All types of Furnace Treated Steels including Carbon Corrected Steels

Double-feed cartridge (two or more diametrically opposed Sure-Bore cartridges and toolbits, each micrometer adjustable) is said to double boring feeds without increasing tool load. Counteraction of the opposed pressures eliminates most of the spring in bar and insures regularity of bore size regardless of variations in stock removal. Cartridges can be inserted in existing boring bars or are available in special bars for specific requirements. Unit is easily adapted for use as a floating reamer.

Portage Double-Quick, Inc, 1026 Sweitzer Ave, Akron, Ohio

MORE DATA? Circle 114, inside back cover

Metal cutting blades, Inscoloy solid HSS non-ferrous units, are available in range of sizes from 4 to 20 in. dia and in thicknesses from 0.025 to ¼ in. for all types of sawing equipment including portable electric saws. Correct teeth are offered for aluminum, copper, brass, bronze, zinc, and plain or backed aluminum siding.

Industrial Sales Co, 2608 Main St, Buffalo 14, NY

MORE DATA? Circle 115, inside back cover

Nylon drill sleeves are offered in new lines of Drill Saver and Use-Em-Up. Physical properties are such that they allow sleeves to accommodate a few thousandths of galling or nicking on the drill shank or in the spindle, yet allow the drill to run in a central position. Sleeves are available in four sizes: Morse taper 1-2, 2-3, 3-4, and 4-5.

Union Twist Drill Co, Athol, Mass

MORE DATA? Circle 116, inside back cover

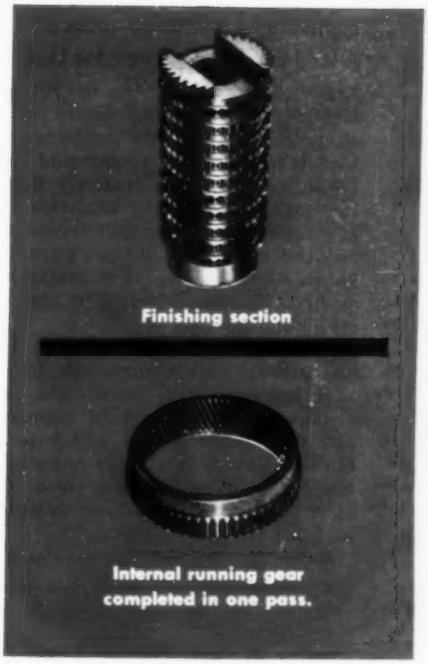
"One of the fringe benefits is that you are not required to laugh at my jokes!"

CLOSER TOLERANCE GEARS IN

HALF THE TIME

by *New* RED RING FULL-FORM FINISHING

Mounting the shell-type finishing section at the rear end of a Red Ring Full-Form Finishing Broach.



Finishing section

Internal running gear completed in one pass.

An entirely new concept in broaching precision gears and splines for automotive and aircraft industries has significantly reduced production costs and at the same time materially improved gear quality. Both roughing and finishing are completed in a single pass of the tool.

Broached tooth surfaces are not only true to form but are entirely free of the generating tool marks which are unavoidable with conventional broaching tools. Surface smoothness checks out between 5 and 8 microinches in the direction of broach travel.

The secret lies in the ingenious design of this new Red Ring broach (patents pending). The roughing section generates gear teeth in the conventional manner. Following the roughing teeth is an interchangeable shell-type section having 12 rows of finishing teeth. Each row cuts about 0.00025″ of stock on the full profile of each side of the gear teeth—hence the remarkable tooth surface smoothness attained.

Using this method on a 3.5″ PD, 35 tooth internal running gear, a prominent transmission builder found broach life of the roughing section to be 50,000 work pieces—that of the finishing section, 150,000 pieces.

Write for specific data regarding the application of Full-Form Finishing to your operations.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

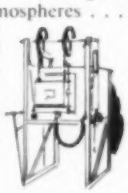
8348

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

WALTER CLEMONS, Furnace Application Engineer, says . . .

LET'S TALK ABOUT FURNACE FLEXIBILITY

Versatility of Operation multiplies the value and economy of Hayes Type LR Preheat and Type CG Superheat Furnaces . . . designed to handle almost limitless hardening and annealing applications. With Hayes external generating equipment, these two standard furnaces are also adaptable to reducing as well as oxidizing atmospheres . . . for treating virtually all types of steels and many non-ferrous metals.



Hayes Type LR Preheat Furnace — Standard Temperature Range 1350-2000° F

"Spare-Tire" Furnaces, they're often called — because each features Hayes patented "Certain Curtain" atmosphere control, ready to act as a stand-by when the external generator is not in use. Muffle and preheat chamber can be added easily for critical heat treating jobs requiring low dewpoint atmospheres.

Hayes Type CG Superheat Furnace — Standard Temperature Range 1600-2400° F

Results Guaranteed! If you're looking for quality, economy, *plus* furnace flexibility . . . let Hayes engineers go to work for you. You'll get complete service right from our laboratory to your production line.

Hayes Type IGL Endothermic Generator — for reducing and carbon potential atmospheres. Sizes from 100 to 20,000 CFH.

Get the facts — Write now for Bulletin 461

C. I. HAYES, INC.

837 Wellington Avenue • Cranston 10, R. I.
Established 1905

It Pays To See Hayes for metallurgical guidance, lab. facilities, furnaces, atmos. generators, gas and liquid dryers.

1959 Metal Show in Print

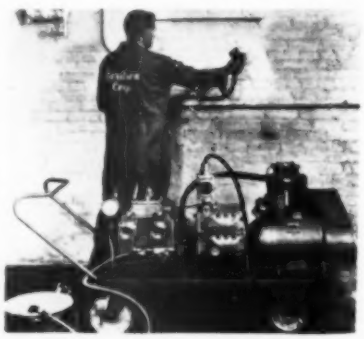
New Metalworking Equipment

by 0.000020 in. directly on the dial indicator with the micrometer set to the nearest thousandth.

Other new Mahr instruments at the show include: dial thread plug gage that performs go-no-go inspection in one operation; water, oil, and shockproof dial indicator for machining tools; and self-centering bore gages that read in 0.000050 in. and check bores from 0.059 to 32 in.

Mahr Gage Co, Inc, 27½ Lafayette St, NY 12 NY

MORE DATA? Circle 117, inside back cover



Airless Spray Painting Unit Offered in Portable Model

New Nordson AP-16000 spray painting unit for production and maintenance jobs is available as a fully portable complete package. It can be plugged into either a 115 or 230-v line. Temperatures of up to 200 F and pressures up to 1000 psi permit maximum spraying efficiency. Features of the Airless Spray System include less overspray, masking, and paint cloud air contamination.

Nordson Corp, 2 Jackson St, Amherst, Ohio

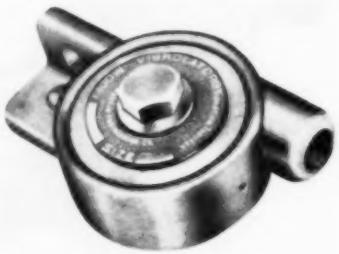
MORE DATA? Circle 118, inside back cover

Metal Processing Aids Exhibited by Houghton

Processing oils and chemicals displayed include coolants, quenching oils, heat-treating salts, cleaners, and rust preventives. Products are Hocut 237, a new non-petroleum cutting coolant; Houghto-Quench fast quenching oils; Mar Tem Salts for heat-treating missile flight chambers; Houghton-Clean 313-A, a combination cleaner-phosphating agent; and a line of rust preventives including Rust Veto 377 that protects with a film only 0.0003 in. thick.

E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Penna

MORE DATA? Circle 119, inside back cover



Lightweight Vibration Inducer Added to Martin Vibrolator Line

BD-10 weighs only 4½ oz yet is claimed to retain the power and strength of the 11-oz predecessor. Unit is fitted with a replaceable jet for even greater air economy than the preceding model. Vibration is generated by a rolling ball driven in an orbit on replaceable raceways of hardened high alloy steel precision ground. Operation is safe in explosive atmospheres.

Special lug allows mounting in any position with a single bolt. Used to bring powdered, particulate, or granular materials out of hoppers and down chutes, unit will handle bins with 4 cu-ft storage capacity. Air consumption is 3 cfm (free air at 80 psi); it will operate on as little as 5 psi.

Martin Engineering Co, Neponset, Ill

MORE DATA? Circle 120, inside back cover

Amplex to Show Powder Metal Parts, Bearings, and Filters

Amplex exhibit of powder metal parts, bearings, and filters will feature new design Iron Oilite 212 bearings.

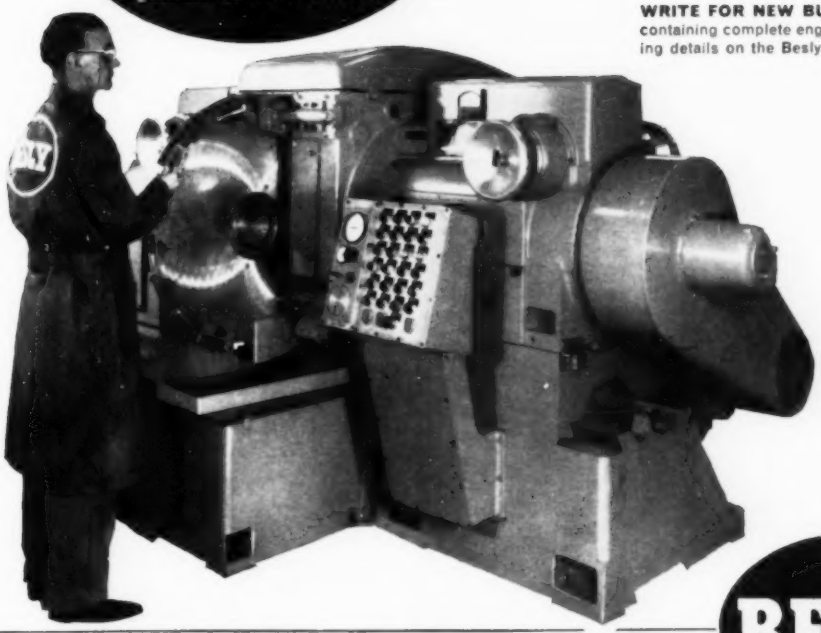
Composed chiefly of iron powders, the Iron Oilite bearings are said to cost considerably less than bearings of porous bronze. They have performance equal to bronze bearings

·Greater Accuracy
·Less Downtime
·Lower Costs!

NEW
BESLY
DH4 Double Horizontal Spindle Disc Grinder

This new grinder is built for top accuracy plus substantial economy. The exclusive Besly precision quill and clutch infeed provides for feed increments calibrated in millionths. Abrasive discs can be changed in 30 minutes without disturbing setup (a 200% saving in downtime over conventional disc grinders)! Dressing time is cut to four minutes (a 500% saving)! Coolant is always under control and the cooling system is insulated from the grinder. Get full facts today . . . convince yourself that the Besly DH4 will help you do better work at lower cost.

WRITE FOR NEW BULLETIN
containing complete engineering details on the Besly DH4.



BESLY-WELLES CORPORATION
120 Dearborn Ave., South Beloit, Illinois

BESLY®

Grinders and Abrasives • Taps • X-Press Taps® • Drills • Reamers • End Mills • Tool Bits • Gages • Carbide Tipped Tools, Blanks, Lapped Toss-away Inserts and Holders

ALLEN

The cost of ALLEN Hex-Socket Cap Screws is only a minor fraction of your assembly costs . . . be sure you're getting the timesaving, cost-saving advantages of genuine Allens!

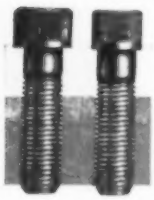
Ever since Allen first produced the hex socket head screw nearly fifty years ago, specifying *genuine* Allens (made by Allen of Hartford) has been a sure way to guarantee dependable threaded fastening.

Only *genuine* Allens have Leader Points that make starting easier, and greatly minimize danger of cross threading. *Genuine* Allens are "pressur-formd" to preserve the long fibers uncut throughout the length of the screw, giving stronger sockets for greater tightening torque.

Write for samples and engineering data. See how *genuine* Allens will make your product better.

ALLEN HEAD
HEX-SOCKET SCREWS

Allen's new 1960 Series Socket Head Cap Screws give up to 2½ times more load carrying capacity, without indentation. Head diameter of sizes from ¼" up is now uniformly 1½ times the body diameter—providing more under-the-head bearing surface, and a proportionate increase in clamping force. Write for new Bulletin G-25, with full specifications.



Stocked and sold by leading Industrial Distributors everywhere

ALLEN MANUFACTURING COMPANY
Hartford 1, Connecticut

Show in Print

where corrosion is not a problem and high mechanical strength is not required, according to the manufacturer.

An oil content of 20% by volume makes the 212 bearings self-lubricating for life on many products. Suggested uses include bearing and bushing uses on light machinery, especially for oscillating and reciprocating motion.

Amplex Div, Chrysler Corp, Detroit 31, Mich

MORE DATA? Circle 121, inside back cover

Tapping Fluid Said to Stop Breakage, Improve Finishes

Rapid Tap is said to release stuck taps, stop tap breakage, increase thread accuracy, and improve surface finishes. The fluid can also be used in reaming, drilling, boring, threading, lathe cutoff, and profile milling.

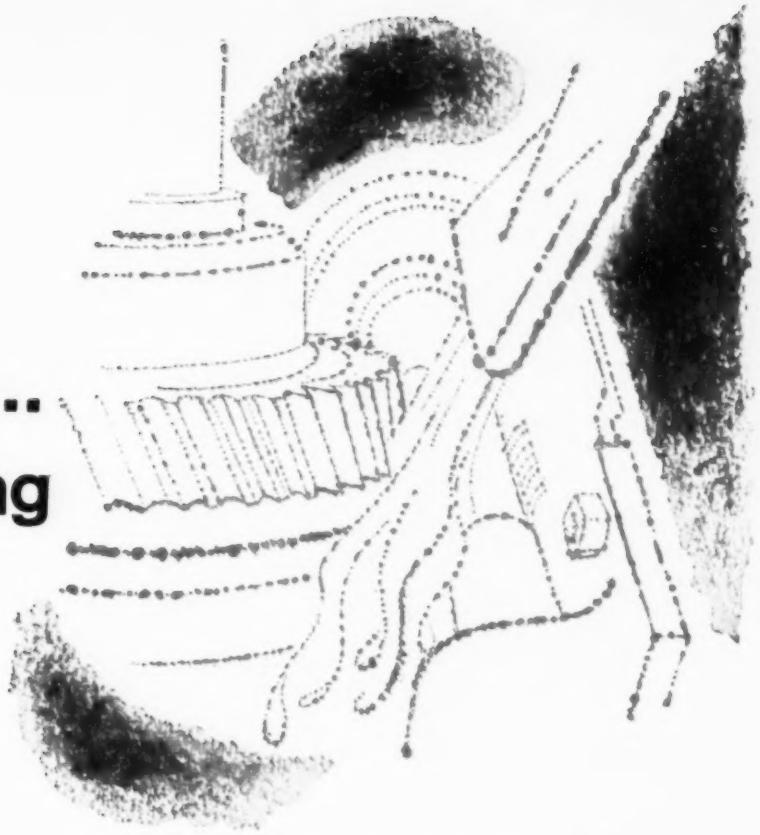
The tapping fluid breaks down surface tension and adhesion resulting from tapping and similar operations. It is effective on such metals as stainless steel, beryllium, copper, brass, bronze, stellite, iron, and magnesium.

Relton Corp, 99 N Lotus Ave, Pasadena, Calif

MORE DATA? Circle 122, inside back cover

"You've been cracking walnuts again."

Hobbing... Cutting Oils... and Reducing Rejects



Fewer rejects mean lower unit cost. For extremely tough jobs, Sinclair Ordnance heavy-duty type cutting oils have earned the reputation—in plant after plant—for increasing production by reducing rejects. Ordnance Oils assure excellent finish, cooler parts and extended tool life. Next time you have a threading, broaching, hobbing or other difficult metal-working operation, show management how you saved money and further reduced rejects with Sinclair Ordnance Cutting Oils.

Call your Sinclair Representative for further information, or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There's no obligation.

Sinclair

Sinclair

Ordnance Cutting Oils

CIRCLE 290 READER SERVICE CARD

PHOTO BY AARON OF OTTAWA

"To achieve best design results—we must have steel of consistent quality"

—J. W. HUBLER, vice president engineering, Macomber Incorporated, Canton, Ohio.

"Engineers of construction products rely heavily on sources of material supply"—says J. W. Hubler, vice president of engineering at Macomber, one of the nation's foremost manufacturers of steel joists, roof decking, and structural steel framing.

"Because the relation of strength to weight is vitally important in the construction business, we design to give the architect the strongest, lightest, easiest-to-use product possible. To do this we must be sure the steel is right—every inch of it. For steel of consistent analysis and quality, we can rely on *Sharon Steel Corporation, Sharon, Pa.*"

SHARONSTEEL

SHARON *Quality* **STEEL**

CIRCLE 291 READER SERVICE CARD

FIELD REPORT...

Chance Vought Modernizing Dallas Heat Treating Facility

A $1 million modernization program is under way to equip the company to handle new exotic metals; it'll provide Vought with higher temperature capabilities than any presently existing facility in the Southwest.

Ninety percent of the equipment will be new. It will include 15 heat treating furnaces, and will be in full operation by the end of next year. Equipment will process steels as well as molybdenum, vanadium, tungsten, columbium, tantalum, and thorium. Temperature capabilities up to 3000 F will be possible and a cold stabilization chamber will be installed in which certain metals can be cooled down to −150 F.

Boeing Payroll Shrinks

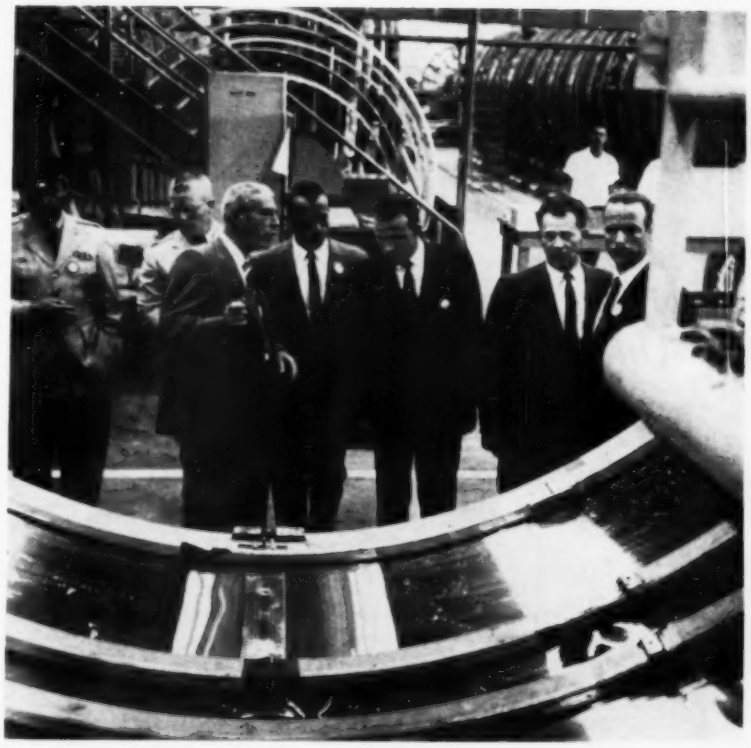
Boeing Airplane employment in Washington state has declined to 62,000, a decrease of 11,000 since the first of the year. It will continue to drop for the balance of this year and probably during 1960, according to company sources. Most of the people laid off have been in the semi-skilled category. In addition, the company has downgraded a number of employees in the higher-grade skills, and in supervision. Employment of scientists, engineers, and technicians has been on the upswing, however. Before World War II only about 7% of Boeing employees were in engineering and technical categories. Today it's 18%. A year from now it'll be 20% and in five years 30%.

A-C Buys Valley Iron Works

Acquisition of assets of the Valley Iron Works, Appleton, Wis, has been approved by the boards of both companies and is subject to approval by VIW stockholders. Change is expected to become effective about Oct 30. Valley will operate as a subsidiary of Allis-Chalmers under the name of Valley Iron Works Corp and will continue to manufacture paper making machinery.

Bendix Expanding in NJ

Bendix Aviation Corp's new semiconductor products plant, scheduled for completion next year, will be a 72,000 sq-ft facility situated on a 118-acre plot in Holmdel. It'll house manufacturing facilities, marketing offices, and engineering and research labs to handle the company's line of power transistors and silicon power rectifiers. Plans also include auditorium facilities for symposiums and technical instruction.



Astronauts see the Atlas manufactured . . .
Three of America's seven astronauts, one of whom will be our first man into space, look over a welding fixture for assembling tank sections of the Atlas intercontinental ballistic missile during a visit to Convair Astronautics, San Diego. Viewing assembly of the Atlas, which will boost the first US manned capsule into orbit, are from left: Major Earl Walker, Atlas project officer; Captain Lloyd Harrison, BMD Mercury project officer; J P Hopman, Convair Astronautics factory manager; Lieutenant Commander Alan B Shepard, Jr, USN; Captain Leroy G Cooper, Jr, USAF; M L Bjorstrom, Convair Astronautics assembly general foreman, and Lieutenant M Scott Carpenter, USN. Shepard, Cooper and Carpenter are astronauts

Norden Expanding in Conn

Norden Division of United Aircraft Corp has bought an 80-acre tract in Norwalk, Conn, for construction of a multi-million-dollar engineering, research, and manufacturing facility. The 350,000 sq-ft building is scheduled for completion in about 12 months.

GE Division to Work on Missile

General Electric's Missile and Space Vehicle Div has been selected reentry vehicle subsystem subcontractor for this country's newest Air Launch Ballistic Missile project. Order came from Douglas Aircraft Co, prime contractor for the ALBM. GE becomes the second of several major subsystem subcontractors to be named for the program. Douglas recently announced the choice of Aerojet-General Corp for development of the propulsion subsystem.

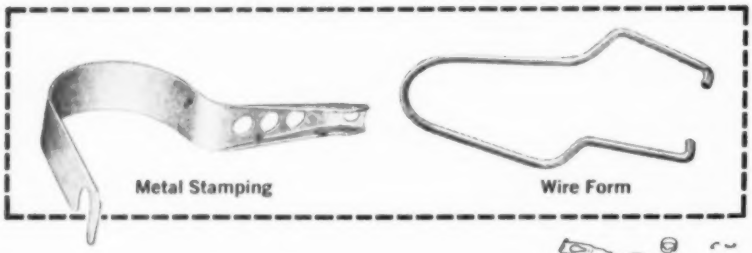
Midland-Ross Divisions Combine

John Waldron Corp, a subsidiary of Midland-Ross Corp, and the Hartig Extruder Division of the same company have been combined and will be known as Waldron-Hartig Division of M-R. Waldron, in New Brunswick, NJ, manufactures flexible couplings and a complete line of process machinery for paper, plastic, film, foil, and metal webs. Hartig Extruders, located in Mountainside,

4 reasons why

Nilson Automatic 4-Slides are "Universal" Forming Machines

1. Form Wire or Ribbon Metal Stock
2. Accommodate Long or Short Pieces
3. Job Versatility through Quick-Change Cams
4. Combine Stamping & Forming in 1 Machine



Every Nilson Automatic 4-Slide is truly a "universal" forming machine, a machine designed to produce either wire forms or metal stampings at high production rates.

Open construction provides easy access to all tooling . . . permits rapid changeover from one stock to the other. And longer feeds, longer slide strokes give a Nilson the built-in ability to handle a wide range of work sizes — without special attachments or accessories.

For real efficiency in your pressroom, just pick the capacity you need from Nilson's 17 models of 4-slides! One of these versatile machines will make your stamping and forming operations faster, easier . . . and more profitable.

SIZE RANGES:
Wire up to ½" diameter
Ribbon stock to 3½" wide
Feeds up to 32"

5 TO 75 TON
PRESS SECTIONS

Write today for the
Nilson General Catalog
on Automatic 4-Slide Equipment

NILSON
THE A. H. NILSON MACHINE CO.
601 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

Field Report . . .

NJ, is a producer of plastic extrusion machinery. Waldron coating, laminating, and web handling machinery is widely used in the plastic and paper converting industry in combination with the Hartig extruders and dies. Combination will provide industry with a single source for complete packaged installations, including extruders, dies, and accessories.

Roper Hydraulics Moves to Ga

Roper Hydraulics, Inc, is moving from Rockford, Ill, to Commerce, Ga. New plant location is about 60 miles northeast of Atlanta. In addition to moving specialized pump manufacturing equipment, company is installing $250,000 worth of new machine tools.

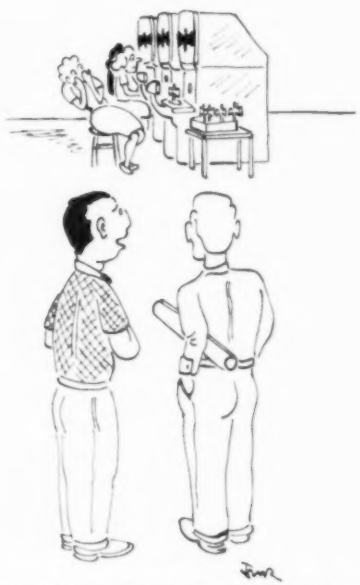
New Metal Fabricating Plant

Conner Fabricators, Inc, recently opened in Pontiac, Mich, is equipped to build automation mechanisms and devices, transfer tables, and automatic loaders. Services offered are complete from planning to drawing board to delivery of the finished product.

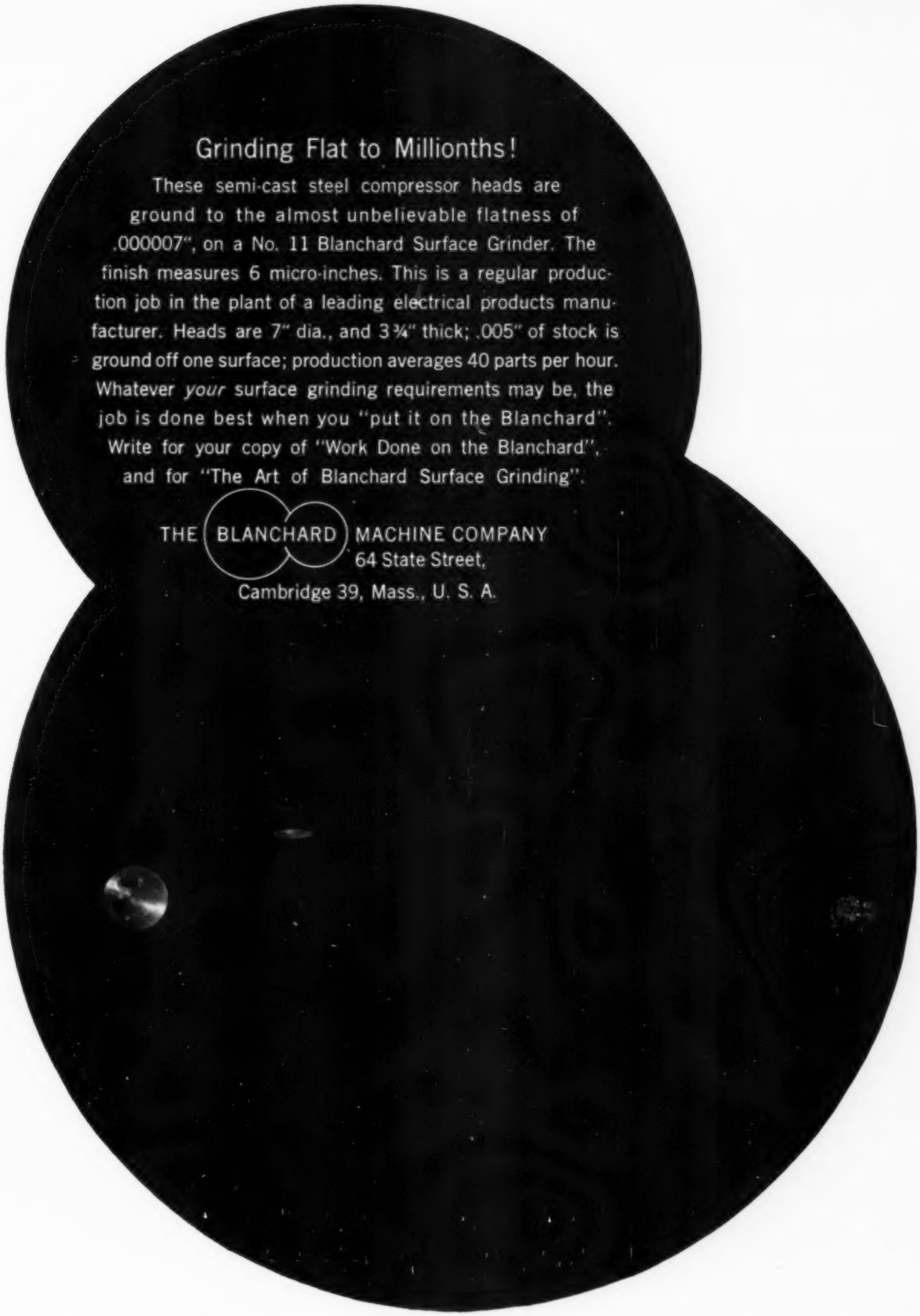
Pullman Buys Swindell-Dressler

The 110-year-old Swindell-Dressler Corp of Pittsburgh has been acquired as a subsidiary by Pullman Inc. Company, which designs, engineers, and constructs furnaces for the ferrous and non-ferrous industries and

(continued on p226)



"Looks like you'll have to let Edna go, Joe. She's getting afraid of her shadow."



Grinding Flat to Millionths!

These semi-cast steel compressor heads are ground to the almost unbelievable flatness of .000007", on a No. 11 Blanchard Surface Grinder. The finish measures 6 micro-inches. This is a regular production job in the plant of a leading electrical products manufacturer. Heads are 7" dia., and 3¾" thick; .005" of stock is ground off one surface; production averages 40 parts per hour. Whatever *your* surface grinding requirements may be, the job is done best when you "put it on the Blanchard". Write for your copy of "Work Done on the Blanchard", and for "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY
64 State Street,
Cambridge 39, Mass., U. S. A.

Now

AUTOMATIC POSITIONING

with the

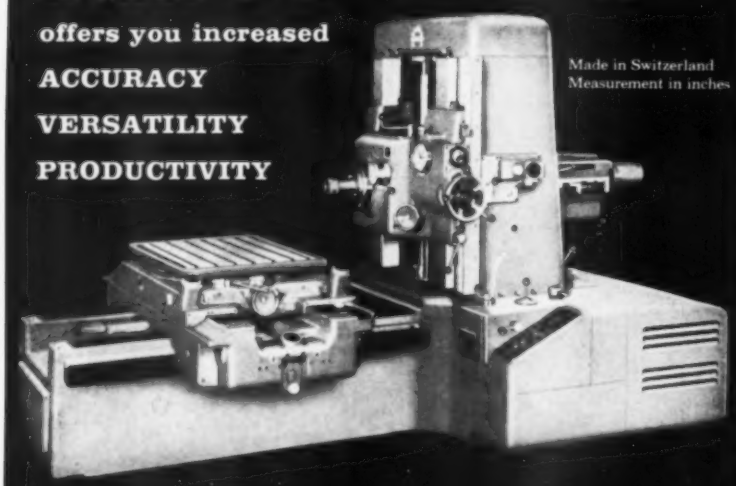
DIXI 75 horizontal optical jig borer

offers you increased

ACCURACY

VERSATILITY

PRODUCTIVITY



Made in Switzerland
Measurement in inches

- Automatic positioning can be changed instantly to manual operation
- Projected optical setting — direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29½" cross travel; 23⅝" longitudinal travel; 25½" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

See the DIXI 75 in operation at the
NATIONAL METAL CONGRESS AND EXPOSITION
BOOTH 1346
International Amphitheater
Chicago
NOVEMBER 2nd-6th

MBI

M. B. I. EXPORT & IMPORT LTD.
A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
"Over 25 years' experience in designing and building machinery."

Field Report . . .

the ceramics industry, will remain at its present location in Aspinwall, Penna. Pullman also operates the business of the former Pullman-Standard Car Mfg Co as the Pullman-Standard division of the parent company, and owns all of the stock of M W Kellogg Co, Trailmobile Inc, and Transport Leasing Co.

True-Trace Merger

Merger of True-Trace Corp of El Monte, Calif, with True-Trace Sales Corp and True-Trace Manufacturing Corp is in effect. All future activities will be conducted as True-Trace Corp. Company designs, manufactures, and supplies hydraulic tracing controls and components to machine tool builders. It also adapts tracer controls to existing machines. Firm will phase out of aircraft contour machining jobbing work and concentrate on its line of machine tool control systems and control components for missiles and aircraft.

Stokes to Build Giant Furnace

Largest cold-wall vacuum heat-treating furnace ever to be built, capable of operation at temperatures of 2150 F, has been ordered from F J Stokes Corp, Philadelphia, by Convair Astronautics Division of General Dynamics, San Diego. It'll be used for heat treating the high alloy steels used in production of the Atlas ICBM. Contract, amounting to more than a quarter of a million dollars, calls for design, fabrication, erection, and turn-key installation of the complete system. Furnace will have a horizontal vacuum chamber 12 ft long and approximately 9 ft in diameter which will be evacuated to working pressures of about ½ micron. Within the chamber will be a uniform-temperature work zone about 10 ft long and 6 ft in diameter.

(continued on p233)

"I'm a success as a foreman . . . they've started calling me 'Bubble Head' Gillins!"

Complex job–or simple job

Kingsburys save money on both

600 valve castings per hour gross with a 14-spindle indexing machine

At the left is high production with a variety of tools — five combination tools, two drills, a hollow mill, a recessing tool for the undercut, a counterbore and three taps.

A 30-inch index table holds seven fixtures. Steel jaws in each fixture hold two parts, one in front for the first chucking and one in back for the second. A spring-loaded ram clamps the parts and an air cylinder unclamps them.

Nine self-contained units perform the operations. Seven have single spindles. Two vertical units have multi-spindle heads; each operates at two stations and in both chuckings.

The machine also handles a part with another tapped hole. The units cycle in 4.5 seconds, and the table indexes in 1.5 seconds, so a part can be finished every 6 seconds.

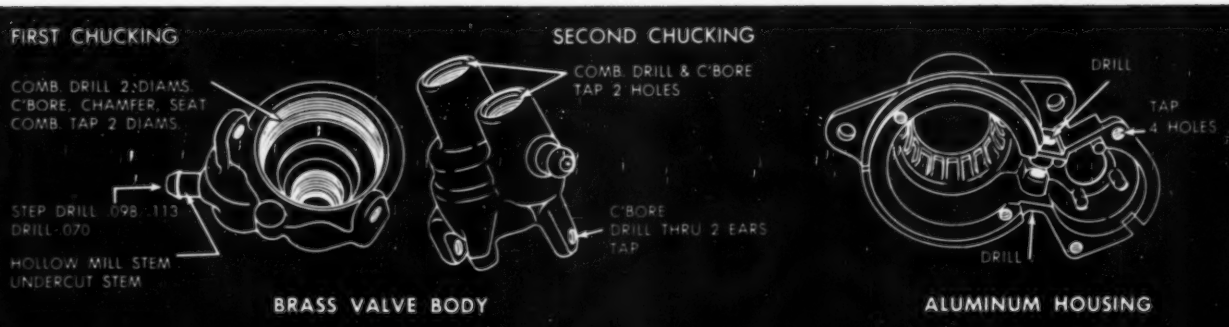
325 aluminum housings per hour gross with a 6-spindle non-index machine

The machine at the right has one fixture. Clamping is manual. Two opposed units drill two holes in line. To avoid tool clash one unit cycles, then a cam-controlled valve trips the other. A vertical unit taps four holes.

Kingsbury machines save money because they produce uniform parts that gage. Good basic design and rugged accurate construction mean few rejects and little down time.

Kingsbury Machine Tool Corporation, Keene, N. H.

KINGSBURY MULTI-UNIT AUTOMATICS



BRASS VALVE BODY

ALUMINUM HOUSING

Announcing

...a fully-automatic precision DRILL POINTER

the

Model 100 WINSLO-MATIC DRILL POINTER

See the **WINSLO-MATIC DRILL POINTER** in operation at the National Metal Show in Chicago — Booth 1362

THE ONLY DRILL POINT GRINDING MACHINE WITH ALL OF THESE OUTSTANDING FEATURES AND ADVANTAGES

- **FULLY-AUTOMATIC CYCLE — INCLUDING EJECTION OF DRILLS**
- **WILL GENERATE HELICAL OR CONVENTIONAL POINTS**
- **DRILL POINTS CONCENTRIC WITHIN .0002**
- **HIGH PRODUCTION RATE — CYCLES IN 3 SECONDS**
- **PACESETTER ADJUSTER SETS INTERVAL BETWEEN CYCLES**
- **LOCATES ON THE POINT — NO ADJUSTMENTS REQUIRED FOR VARIATIONS IN DRILL LENGTHS**
- **FULLY AUTOMATIC SELF-COMPENSATING WHEEL DRESSER**

Here is one of the most sensational machines ever to be introduced to industry! The Model 100 WINSLO-MATIC DRILL POINTER produces *automatically and with extreme precision*, the Winslow Type 4 drill points or other helical (self-centering) points, as well as conventional points. And in addition, the drill point on most drill countersinks can be sharpened with this machine.

Forms are generated by means of a combination of 2 cam movements. The drill point angle is formed on a 20" diameter grinding wheel. The number of drills pointed between automatic dressings is pre-determined by a selector switch. The WINSLO-MATIC DRILL POINTER operates on a single source of power (electrical). Grinding wheel and work-head are well guarded to retain coolant and spray, assuring a clean, anti-splash operation. Unit occupies only 36" x 48" floor space. Work-head is at convenient level for maximum ease of operation.

No other machine can match the precision, production and labor-saving advantages of the revolutionary WINSLO-MATIC DRILL POINTER. Write for full details today!

WRITE TODAY ... for WINSLO-MATIC DRILL POINTER Bulletin and name of your nearest dealer.

Winslow PRODUCT ENGINEERING CORPORATION

47 ST. JOSEPH STREET • ARCADIA, CALIFORNIA

Manufacturers of power hand tools and accessories for the nation's aircraft and manufacturing plants.

THREE OTHER WINSLOW POWER TOOLS YOU SHOULD KNOW ABOUT ...

SPACEMATIC DRILL MOTOR — An extremely versatile tool that drills, reams and countersinks in a single operation.

NUTPLATE DRILL MOTOR — A portable power tool used on Nutplate installations.

SPACEMITE DRILL MOTOR — A heavy-duty tool that replaces angle drills for limited-access-area drilling.

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

How to stretch belt life polishing stainless to #4 finish

Mattison's diamond-head machine design keeps belts clean and cool at Atlas Steels, Limited

More production per square inch of abrasive belt—that's one of the advantages of Mattison's four-roll head design at Atlas Steels, Limited, Welland, Ontario.

The obvious reason for long belt life is longer belts—more time between cuts for cooling. Another is that these 243-in. long belts undergo four "flexes" instead of two, giving them a better chance to "break loose."

But long belt life is not the only advantage of a four-roll head. Quality is higher, too. For one thing, the belt doesn't "wrap" on the contact roll. A flatter angle of attack permits the belt to conform more closely to the uneven surfaces of the sheet. This produces a better scratch pattern and accounts for the incomparably high finish obtained on many jobs.

Specialization is another factor. In the Mattison head, one roll aligns the belt, one drives it, and another applies the pressure. The fourth is an idler and simply increases flexing action. Separation of the contacting and driving functions means motor pulsations cannot be transferred to the finish.

These features have paid off in higher quantity and easier control of quality at Atlas. Company officials estimate that not *two sheets in a million* are lost due to machine performance. A #4 finish is consistently produced on as many as 150 tons of stainless sheets per month.

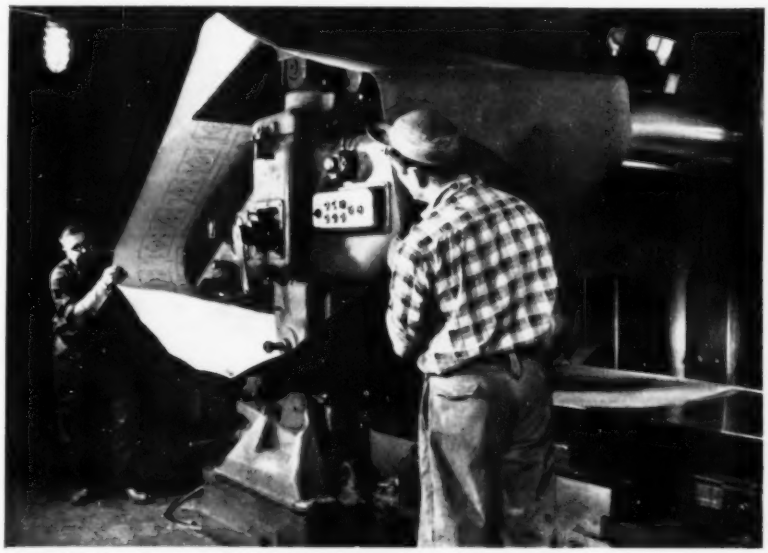


Fig. 2—Belt replacement on the 50" machine requires less than five minutes' downtime. Belts are 243" long and range from 50 grit for roughing to 120 and 150 grit for finishing. Plain rubber contact roll is 35 durometer.

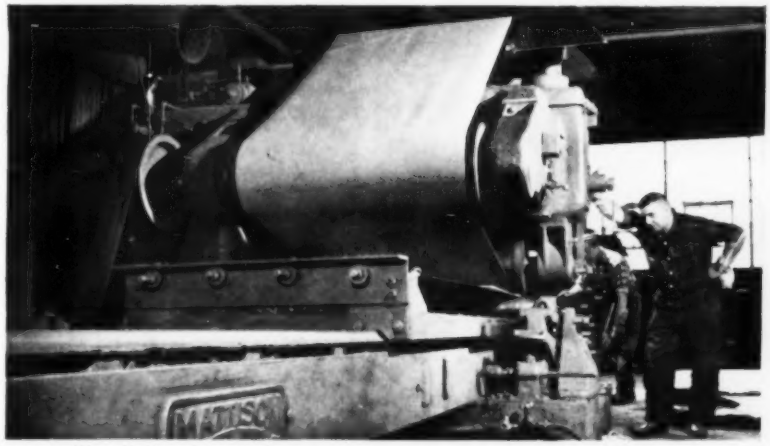


Fig. 3—Simplicity of controls means the operator can concentrate on the fine points of producing a #4 finish. Cutting speed is 3600 sfpm. Stock removal averages .003 in.

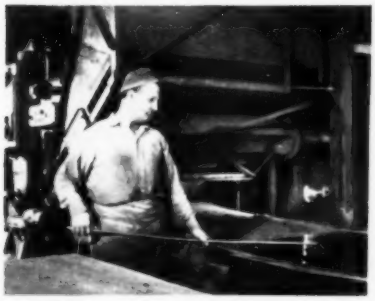


Fig. 1—General-purpose petroleum base lubricant is applied by swabbing.

Less than 2% downtime

Two Mattison No. 455 abrasive belt grinding and polishing machines are frequently used on 24-hour production schedules and yet have recorded less than 2% downtime since 1952. In the words of one Atlas official: "Performance has been failure-free with downtime restricted to scheduled maintenance once or twice a year."

MATTISON MACHINE WORKS
Rockford, Illinois Phone 2-5521

Want More Information?

Write for free literature describing the Mattison No. 455 Reciprocating Table Sheet Polisher or No. 456 Pinch Roll Grinder for single-pass work.

MATTISON MACHINE WORKS
HIGH-POWERED PRECISION SURFACE GRINDERS

CIRCLE 298 READER SERVICE CARD

CIRCLE 299 READER SERVICE CARD ►

AIRCO
INDUSTRIAL
AND RARE
GASES

ARGON
OXYGEN
ACETYLENE
NITROGEN
NITROUS OXIDE
HYDROGEN
CARBON DIOXIDE
HELIUM
XENON
KRYPTON
NEON

Saturated nitrogen vapor test chamber, custom-designed and built by Stewart-Warner, working with Air Reduction's Technical Service Organization. When readied by the technician, chamber was sealed. *Cold* nitrogen vapor then was introduced and used at approximately −300 F.

AIRCO INDUSTRIAL GASES... PART OF THE PICTURE IN CRYOGENICS ENGINEERING

at Stewart-Warner

Here's how South Wind Division of Stewart-Warner used Air Reduction Nitrogen and Helium in testing liquid oxygen valves

In testing the efficiency of liquid oxygen tank vent valves developed for missiles, Stewart-Warner utilized Air Reduction liquid nitrogen as a "stand-in" for liquid oxygen.

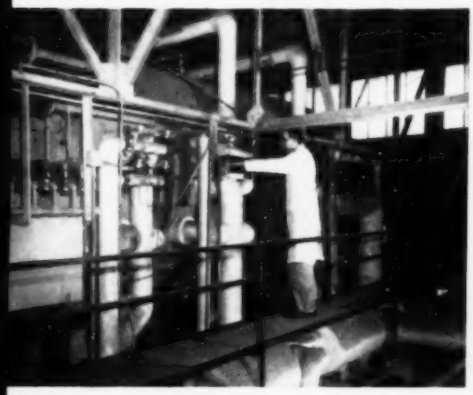
The reasons why were good ones: the data on easy-to-work-with nitrogen could be applied to predict the behavior of oxygen under similar conditions; nitrogen does not combine easily; it is incombustible.

In the vital leakage tests of the valves, Air Reduction helium was employed. Complete tightness of the shutoff mechanism was mandatory, and the high diffusion rate of helium best qualified it to serve in this phase of the testing operation.

In order to assure a steady supply of nitrogen and helium, Air Reduction's Technical Service Organization set up, adjacent to the Stewart-Warner laboratory, both a permanent installation for liquid nitrogen and a helium manifold.

This is but one area of cryogenics where Air Reduction gases—and technical knowledge—are being used extensively. Here, as elsewhere, a principal feature of Airco Industrial Gas Service is absolute dependability of supply.

If you use industrial gases, or think one of them might help improve a process or product in your operation, call in your nearby Airco Engineering Service Representative. Let him show you how your needs can best be met by Air Reduction . . . most experienced supplier of high purity industrial gases.



Refrigeration equipment for further tests. Choice of Airco assures dependable supply of industrial gases for *cryogenic* testing—from the Greek word meaning, "Creation of icy cold."

Test data and control panel. Under such precision controls, Airco gases are advancing frontiers in many industries such as missiles, aircraft, electronics, steel, chemicals, and food processing.

Airco's liquid nitrogen installation at the Stewart-Warner cryogenics lab, in Indianapolis. Helium manifold far right. These facilities make it practical to maintain reserves of both vital gases.

AIRCO

AIR REDUCTION SALES COMPANY

A Division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

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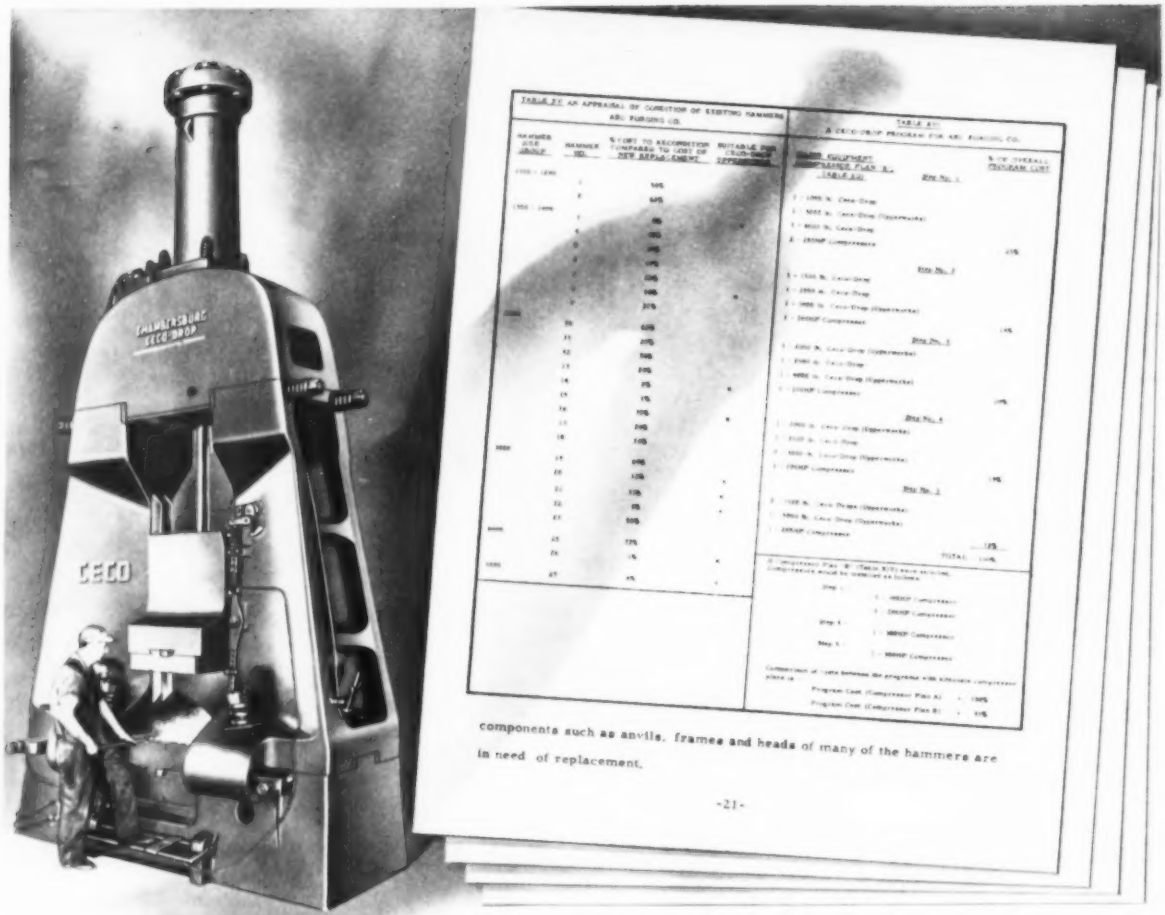

The
CECO-DROP
and its place in forge shop modernization

A Realistic Approach to Forge Shop Modernization

During the past few years, mounting competition has caused forge shop managers to seek ways to further increase production and reduce costs. A number have scrapped their old board hammers replacing them with Ceco-Drops, the modern piston-lift gravity-drop hammer. These shops have thus placed themselves in a position to get more business—and they are getting it! ● A wealth of helpful information is available in Chambersburg's new 28 page forge shop modernization bulletin. Based on studies made in prominent forge shops, this publication assists you to formulate your own step-by-step modernization program. Write for a copy today.

CHAMBERSBURG ENGINEERING COMPANY · · CHAMBERSBURG, PA.

◄ CIRCLE 300 READER SERVICE CARD

CIRCLE 301 READER SERVICE CARD

Field Report . . .

Barco Expands in Canada

Barco Manufacturing Co, Barrington, Ill, has relocated and expanded its manufacturing facilities at Windsor, Ontario. Its former Canadian facilities were in Walkerville, Ont. New Windsor plant is equipped to handle production of Barco specialties in the industrial, railroad, and construction tool fields. It's also planning to handle metalworking and molding contract manufacturing assignments for other American firms presently without Canadian facilities.

Alan Wood Steel Co . . .

. . . is planning an expansion that'll cost more than $25 million. Among the new facilities will be a modern, wide, combination blooming and plate mill.

Ohio Knife Buys Reamer Rights

Ohio Knife Co, Cincinnati manufacturer of tungsten carbide and HSS blades for the metalworking industry, has purchased manufacturing rights to the John M Rogers patented, inserted blade type reamers and mills from the Oak Engineering Co, Gloucester, NJ. Complete line of blades now used in the various reamer and mill bodies is carried in stock by Ohio Knife.

Westinghouse Contracts

Two Navy orders totaling $16.1 million have gone to Westinghouse Electric Corp's aviation gas turbine division. An $11.3 million contract is for production of the company's new model J34-WE-48 jet aircraft engine through August 1961. It'll become effective on completion of an existing Bureau of Aeronautics production order. A $4.8 million contract covers an engineering devel-

(continued on p237)

"My taxes are staggering, but they won't drop."

by Design

BIJUR

AUTOMATICALLY ASSURES CUSTOMER SATISFACTION

the user of your machines

- Increases Productive Capacity
- Saves on Repair Bills
- Eliminates Costly Hand Oiling
- Reduces Downtime
- Lengthens Machine Life

WITH Bijur Automatic Lubrication as an integral part of your equipment, your customers benefit from continuous peak production. Plant after plant reports increased out-put and greatly reduced maintenance costs with Bijur-equipped machines. Costly downtime for lubricating by hand is eliminated. Every bearing is metered the proper quantity of oil at predetermined intervals. Work spoilage and bearing troubles caused by over-lubrication are avoided. Fire hazards are reduced. Personnel accidents are prevented.

Bijur gives you the opportunity to add customer satisfaction through improved machine performance.

More than a million Bijur-protected machines are in use. Hundreds of leading manufacturers standardize on Bijur as "built-in" components of their machines. Bijur emphasizes custom-engineering, and we will gladly cooperate in designing a system to meet the specific requirements of your machine.

Design Bijur into your machines now in production or in the planning stage. Write for literature and engineering information.

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LUBRICATING CORPORATION
Rochelle Park, New Jersey

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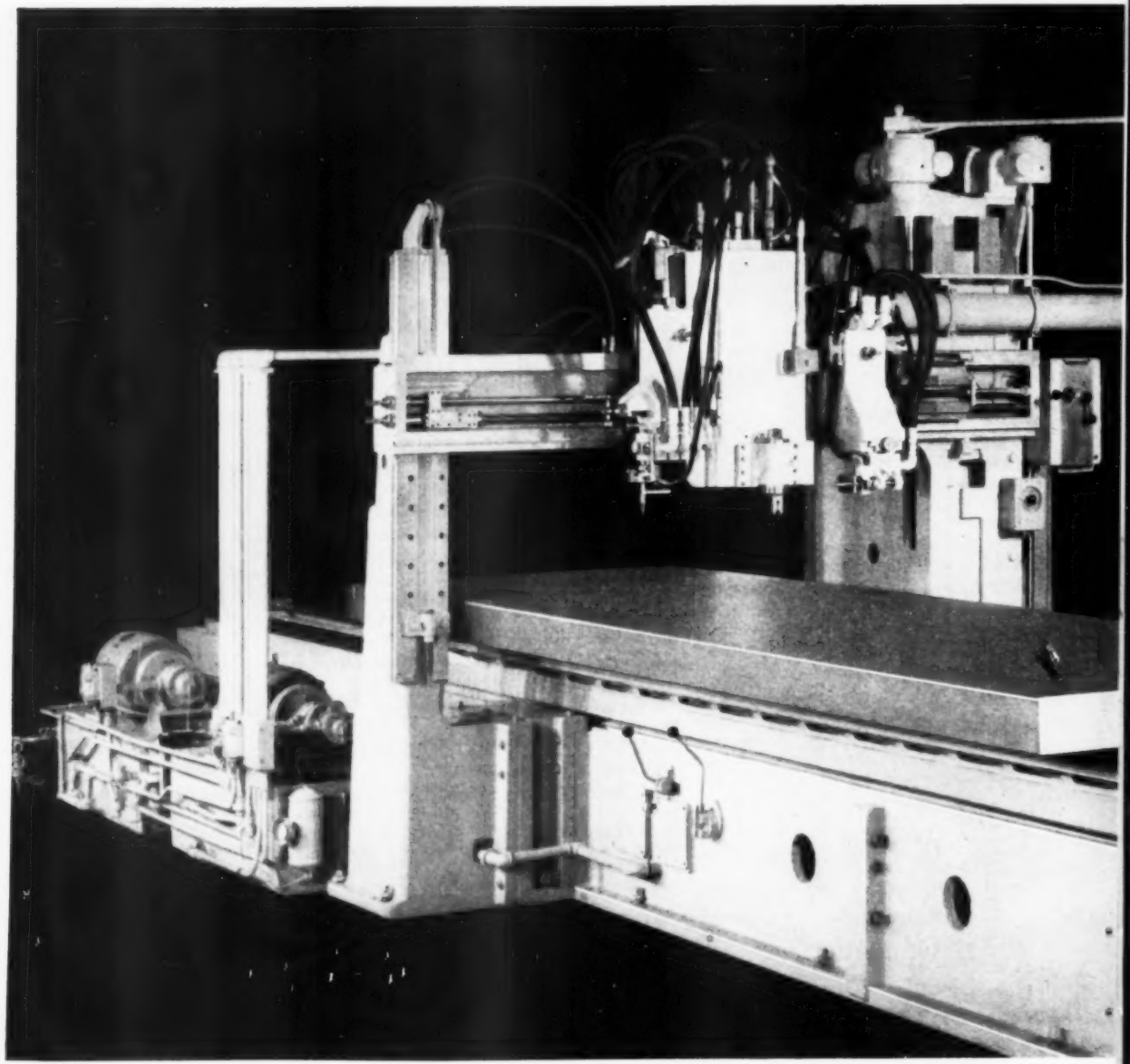
CIRCLE 302 READER SERVICE CARD

Nothing does the job like a



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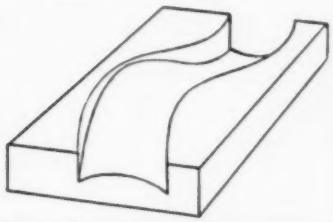
HYDRAULIC

TRACER-PLANER

MACHINES COMPLICATED CONCAVE-CONVEX AIRCRAFT PARTS IN ONE-TENTH FORMER PRODUCTION TIME



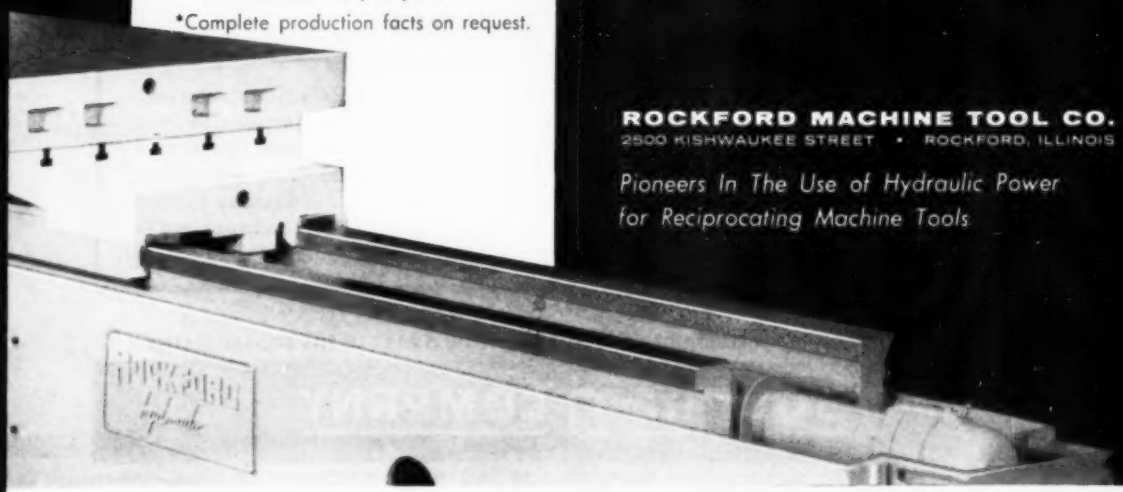
Actual savings on spar-like aircraft parts*:

- One set-up completes machining, no hand finish
- Risk of tool breakage involves only simple planer tools.
- Produces parts from rolled billets instead of expensive forgings.
- Produces parts from inexpensive masters.
- Eliminates forging dies, machining matrixes and warped parts.

*Complete production facts on request.

Nothing performs like hydraulic power...

- Infinitely adjustable feeds and speeds;
- Smooth, uniform cutting pressures for finer finish;
- Maximum metal removal per H.P. expended;
- Low Costs for machining, cutting tools and maintenance.



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Handle Any Adjustable-Speed Job with One of these Square D "packages"*

One of 13 CUSTOM DRIVES for an automotive plant for control of 6 miles of monorail conveyors

* a Square D "package" includes the power conversion unit, operator's station, and drive motor

ELECTRONIC DRIVES

employ advanced designs using more static elements and less tubes. Fail-safe circuits prevent motor runaways. Available in sizes from 1/20 H.P. through 40 H.P.

STATIC POWER MAGNETIC AMPLIFIER DRIVES

provide top reliability and simple maintenance. Save both floor space and weight as compared to conventional drives. Available in sizes through 400 H.P.

MOTOR-GENERATOR DRIVES

use static regulators and rectifiers for simplified maintenance. Rugged, heavy-duty components are provided in each drive. Available in sizes through 400 H.P.

CUSTOM DRIVES

for every possible adjustable-speed requirement can be designed for you using combinations of the above units, plus special units, with accuracies to fractions of 1%. The answer to your adjustable speed problem is as near as your Square D field office.

No matter what adjustable-speed requirements you may have, you can select a Square D drive to meet them exactly. Moreover, every component—from control to drive motor—is subjected to a complete electrical test, and the entire drive is test-run at the factory to assure top performance on the job.

***Write** for complete details. Ask for Adjustable-Speed Bulletin. Square D Company, 4041 North Richards St., Milwaukee 12, Wis.*

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

Field Report . . .

opment program on turbojets at the Westinghouse plant. The new agreements will maintain present levels of production at the jet engine facility located in Kansas City, Mo. And recent awards of spare parts orders totaling over $7.5 million brings to more than $24 million the amount of new business received by the plant in a 60-day period.

Burroughs' Desk-Size Computers

Fifty low-priced (less than $12,000) computers, first ever developed specifically to handle day-to-day computational problems of business and government, have been delivered to date by Burroughs Corp. First deliveries of the Series F2000 were made in August and company has a backlog of orders for another 500 units worth about $5 million. Machine that can be operated by girls trained in less than two hours, averages 30,000 calculations per day.

Solid Propellant Rocket Motors . . .

. . . will be built in a $1 million facility at Mesa, Ariz, to be constructed by Rocket Power Inc, newly formed subsidiary of the Gabriel Co, Cleveland. Motors consist of a solid propellant, plus hardware, plus an igniter. New Mesa installation will produce mainly the solid fuel; other Gabriel divisions will manufacture some of the hardware and some of it will be purchased on the outside under subcontract arrangement. New Rocket Power plant will produce 100,000 lbs of solid propellants per

"He gave me sort of a conditional raise . . . when hell freezes over."

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2 Models
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Many Di-Acro Precision Metalworking Machines are known throughout industry for their "Die-less Duplicating" performance—producing parts to die accuracy at a fraction of die cost. A great variety of experimental and production parts and components can be made to close tolerances without dies using one or more Di-Acro machines in combination.
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CIRCLE 306 READER SERVICE CARD

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is more modern than...
is more economical than... GAS

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INDUSTRIAL GAS BURNERS & FURNACES
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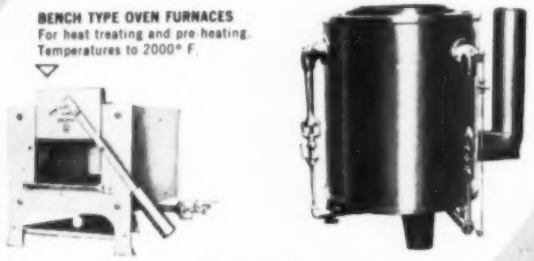
for Clean, Fast, Quiet Heat-Up at Lowest Cost!

BENCH TYPE OVEN FURNACES
For heat treating and pre-heating.
Temperatures to 2000° F.



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For cyanide, salt bath and lead hardening. Temperatures to 1650° F.

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Use rugged, reliable "Hole Hog" machine tools for such jobs as:

★ Multi-Spindle Boring ★ Single and Multi-Spindle Honing
★ Straight Line Multi-Drilling ★ Adjustable Spindle Drilling
★ Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
★ Special Multiple Operation Machine Tools

Twenty-Station, Ten-Unit Transfer Machine for boring, counterboring, chamfering and valve clearance operations on V-8 automotive engine blocks. (Shown)

Over 58 years of MachineTool Engineering experience is at your service. Tell us your particular problem.

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REPRESENTATIVES IN PRINCIPAL CITIES

Field Report . . .

month in 50,000 sq ft of working area with 100 to 150 employees within the first year of production. Production is scheduled to start late this year or very early in 1960. Company hopes to capitalize on markets for smaller, less powerful civilian applications of solid propellant rocket motors which have been largely by-passed by other firms in the general field. However, it has also set up a research group to explore the exotic high-energy fuels and it may eventually get into the prime contract missile field.

Eaton's Forge Division Spending

Plant improvement projects to cost $1 million are in the works for the Marion Forge Division of Eaton Manufacturing Co in Marion, Ohio. Plant makes components for medium and heavy-duty motor trucks. Expenditure for new equipment follows an improvement program started late last year on which company is currently spending over $600,000. Latest program includes installation of a new forging press, new billet heating furnace, and necessary materials handling equipment. Additions will substantially increase heating and forging capacity of the plant.

Electronic Specialty's Backlog Up

Contract in excess of $500,000 has been placed by Douglas Aircraft with Electronic Specialty Co, Los Angeles, for electronic fusing timers for the Genie air-to-air missile. Timers will be manufactured by the company's Avionics Division. Long range planning on the Genie missile program indicates a potential of substantial follow-on orders. Contract brings Electronic's backlog to approximately $4.4 million; it was $2.1 million a year ago.

(continued on p242)

"Mind returning my set of gages, Joe? I have another chance to loan them out."

A 3M Case History Report

CONTOUR POLISHING

DEBURRING-POLISHING TIME CUT 40% WITH "PG" WHEELS

MANUFACTURER: LeTourneau-Westinghouse Company

ADDRESS: Peoria, Illinois

PRODUCT MANUFACTURED: Earth Moving Equipment

3M ABRASIVE USED: "PG" Wheels

HOW 3M ABRASIVES ARE USED: "PG" Wheels used for contour polishing of air brake backing plate. Malleable cast-iron plate requires super-smooth finish on two concentric rings, to provide air-tight seal against neoprene air diaphragm.

OPERATIONAL DATA ON 3M METHOD: Two 1" x 10" "PG" Wheels, Grit #150 Three-M-ite Resinbond Cloth, mounted side-by-side on shop-made polishing shaft uniformly deburr and polish plate ring surfaces in 2-3 minutes.

OPERATIONAL DATA ON PREVIOUS METHOD: Overall deburring and polishing was by hand-rubbing with emery cloth. Time required was 4-6 minutes per plate.

PROVEN ADVANTAGES OF 3M METHOD: "PG" Wheel method, as opposed to hand finishing, allows more uniform finishing as abrading pressure can be more constantly applied with machine. Average time saving of 40% realized.

WANT MORE INFORMATION? Send for free manual, "Modern metal finishing with 3M 'PG' Wheels." Write to 3M Co., St. Paul 6, Minn., Dept. AAA-109.

"PG" Wheels are manufactured in U.S.A. by 3M Company, St. Paul 6, Minn. Export: 99 Park Avenue, New York. Canada: London, Ontario

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How to use coated abrasives to cut costs, improve production, shown in the new 476 page book
COATED ABRASIVES
MODERN TOOL OF INDUSTRY
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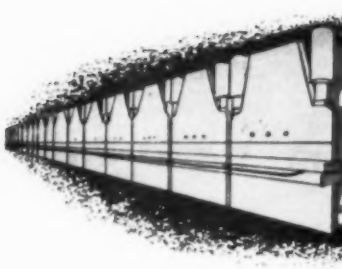
3M Coated Abrasives

"PG" WHEELS

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY



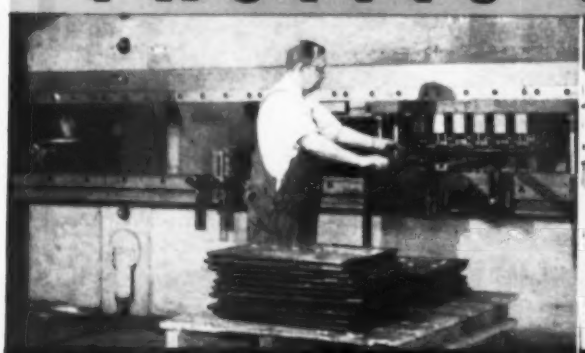
4,769 years to arrive ACCURATE HYDRAULIC

122 out of 124 hydraulic press brakes in U.S. aircraft industry are PACIFIC

Aircraft manufacturers work to the closest tolerances of all industries in metal forming. Douglas Aircraft Company, Tulsa, Oklahoma, with 8 Pacific Brakes (above) is typical of the airframe manufacturers who have selected Pacific for its precise accuracy.

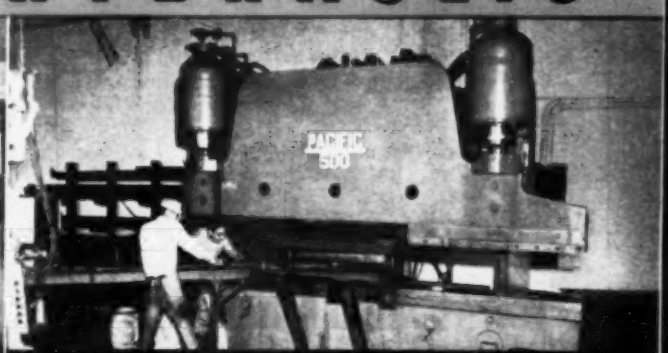
924 PACIFIC Brakes, representing over 95% of all hydraulic press brakes in use today, have operated for an aggregate of 4,769 years to test and confirm PACIFIC designs that have established hydraulic press brakes as far more profitable to operate than mechanical brakes. However, only PACIFIC has precise accuracy, versatility, high speed and dependability that comes from years of experience in manufacturing, developing and improving this unique machine. It is the only hydraulic press brake in daily operation that is actually air bending, straightening, deep drawing, blanking, and doing heavy punching. Accuracy within thousandths of an inch (greater than with any mechanical or other hydraulic brake) repeats itself on every stroke. Ram remains level regardless of location of work on the bed. PACIFIC sizes range from 60 tons to 1500 tons.

PACIFIC HYDRAULIC



Only hydraulic brake built for HEAVY PUNCHING

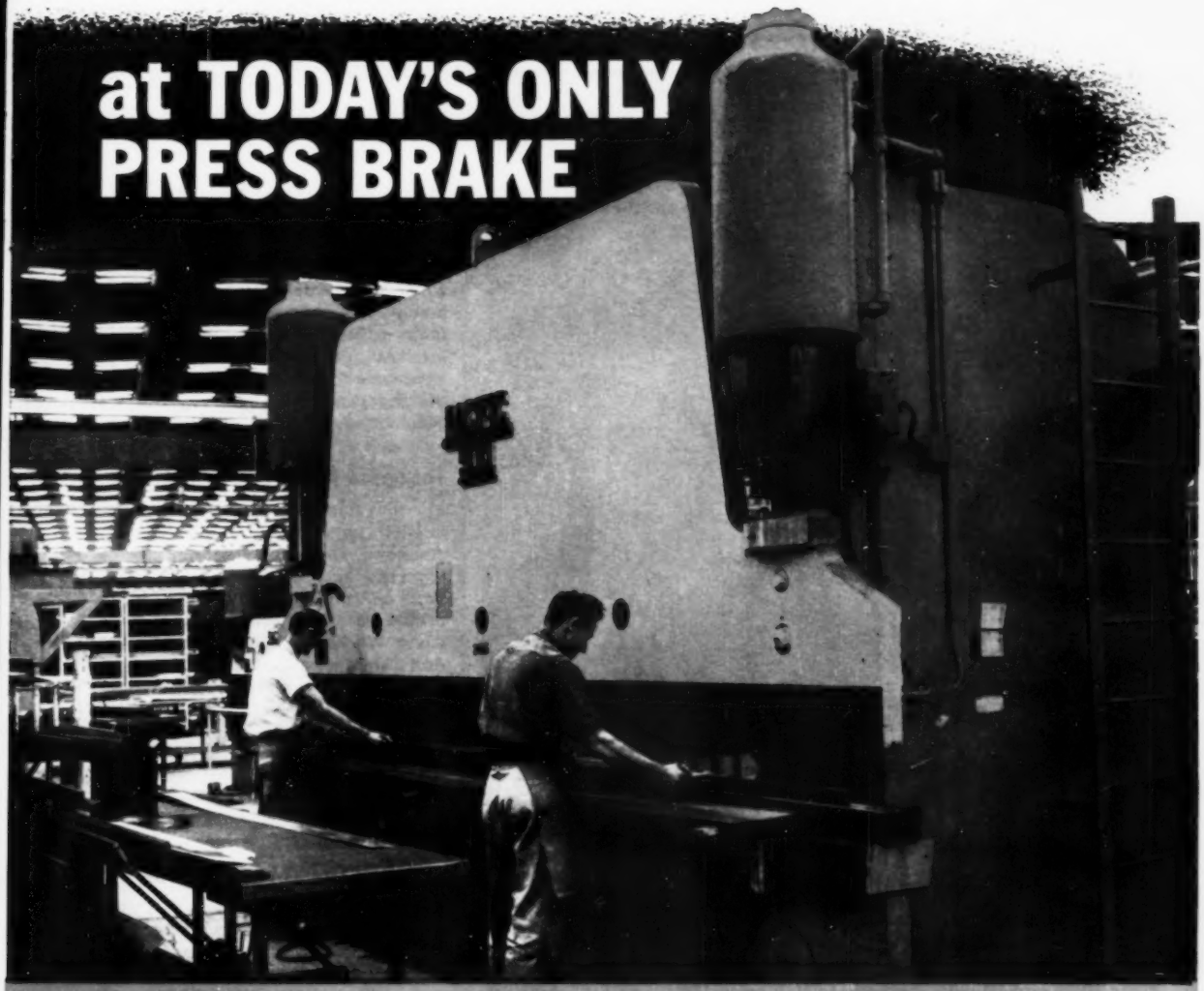
Pacific is uniquely designed to absorb heavy shock from punching in the hydraulic system rather than in the frame of the brake. Cushioned against shock, punch and dies stand up from 3 to 8 times longer than with mechanical brakes. Photo (above) shows 1" alloy steel plate being punched at earthmoving equipment plant.



MAINTENANCE-FREE for years

Dependable, simplified electrical and hydraulic controls can easily be kept working continuously by any plant maintenance crew. There are no complicated electronic devices. In photo (above) at agricultural equipment plant, the 500 ton Pacific Hydraulic Brake shearing ¾" alloy steel plate with Pacific Shearing Attachment has operated continuously for the first 4 years at a cost of $5.22 in replacement parts.

at TODAY'S ONLY PRESS BRAKE



PRESS BRAKE

HIGH SPEED operation

Pacific adjustable stroke length can be shortened for rapid stroking. Automatic, self-leveling ram permits use of progressive dies across entire bed of press. The automatically-fed Pacific at automotive parts plant, which can cycle up to seventy 1½" strokes per minute, is forming 3780 operations per hour in the above photo. In virtually any operation, Pacific's high cycling speed equals or exceeds materials handling capacity.

Write for brochure

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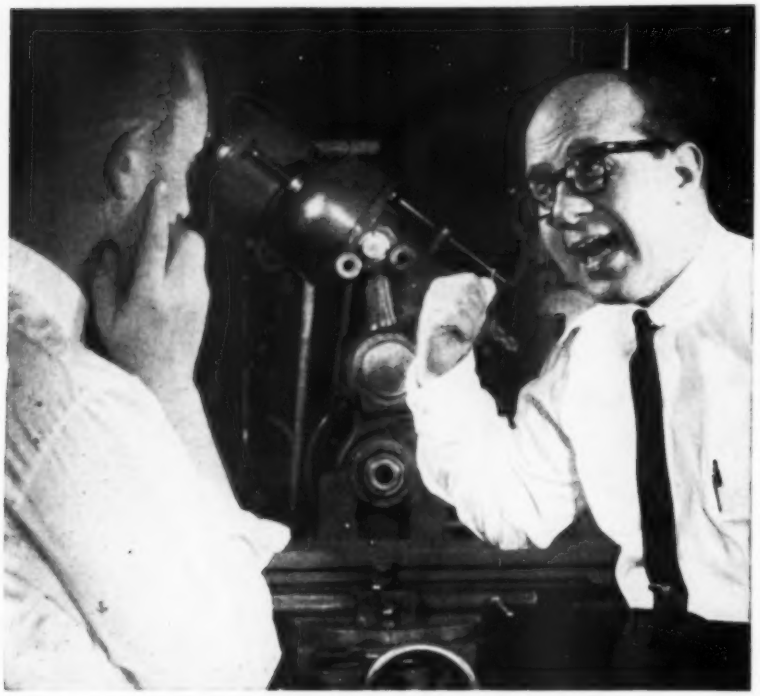
CIRCLE 311 READER SERVICE CARD

TORIT DUST COLLECTION ENDS THIS:



"OUT OF PRODUCTION FOR THREE DAYS? THAT'S WHEN WE'RE SUPPOSED TO SHIP!"

"And believe me, that wasn't all the boss said! Two key machines were so clogged with dirt and grime we had to disassemble and clean them—overnight! Between overtime for the repair crew and our own crew, I managed a partial shipment in three days. And I made up my mind this wasn't going to happen again!

"I'd heard of preventive maintenance with Torit Dust Control equipment—and the Torit representative I called sure opened my eyes! Clean machines hold close tolerances better and up to 80% longer! Torit collectors remove over 99% of dust and air-borne debris, save on both the cost and frequency of servicing.

"I expected there'd be a hitch on prices—but look what I found out: our production breakdown cost nearly as much as the Torit equipment we needed! And just while Torit Dust Collectors are being depreciated we'll make money on them—through maintenance savings, improved production, and reduced down-time!

"The boss actually congratulated me when I showed him the savings Torit preventive maintenance gives us!"

Torit Dust Collectors stop dust build-up before it costs you money. They're available in both high efficiency cyclone and cabinet type units. Why not check into them today—write:

TORIT manufacturing company

1133 Rankin Street, St. Paul 16, Minn. Dept. 420.

Field Report . . .

Calumet & Hecla Buys Flexonics

Agreement has been reached for acquisition of the stock of Flexonics Corp, Maywood, Ill, by Calumet & Hecla, Chicago fabricator of nonferrous metal tube and parts. Transaction is expected to take place in January; company will be operated as a C&H subsidiary. Flexonics, which had sales totaling approximately $20 million last year, manufactures flexible metal hose, synthetic hose products, metal bellows, expansion joints, compensators, and ducting assemblies for industrial, automotive, aircraft, and missile use.

Thompson Ramo Wooldridge . . .

. . . has started construction of a $2 million plant on a 48-acre site in Anaheim, Calif, for research, development, and manufacture of aircraft and missile products. To be operated as the Tapco Group West Coast Works of TRW, it'll make aircraft and missile systems hydraulic products, structural members for aircraft, and rocket motor cases for missiles. Initial building program will cover a quarter of the site. Initial payroll will be 400; future expansion could cover a total of 1500 employees.

US Steel Div has Launcher Order

US Steel's Consolidated Western Steel Division has a contract from Convair Astronautics Division of General Dynamics to fabricate 14 launchers for the Atlas ICBM. All units will be made at Consolidated's Maywood, Calif, plant. Measuring approximately 20 ft wide and 27 ft long by 20 ft high, the rectangular launcher frame will be fabricated of heavy welded steel pipe and tubing and will weigh about 37 tons when assembled.

Burgess-Norton Expanding

Burgess-Norton Mfg Co, Geneva, Ill, has bought facilities including 140,000 ft of manufacturing floor space that'll be used to meet growing production needs. Company makes sintered metal parts, cold extruded metal parts, crushed tungsten carbide abrasives, and hydrogen - copper brazed assemblies.

Telemeter Magnetics, Inc . . .

. . . Los Angeles, has acquired Invar Electronics Corp, Pasadena manufacturer of solid state power supplies and electronic instruments.

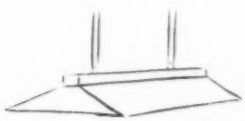
GE Plans Major Expansion Of Its Insulating Materials Dept

General Electric has scheduled a 5-year, multi-million-dollar expansion program for its insulating materials department in Schenectady to accelerate development of new products. Department will move gradually from its present facilities in the main plant to another building on a 32-acre site. Move will facilitate setting up of new processes in a major drive to develop new products and to serve the entire electrical industry. First step will involve expenditure of more than $1 million to modernize existing facilities and to construct a new manufacturing plant. This phase of the program is expected to require 18 months.

Chevrolet's Corvair Puts 6200 to Work

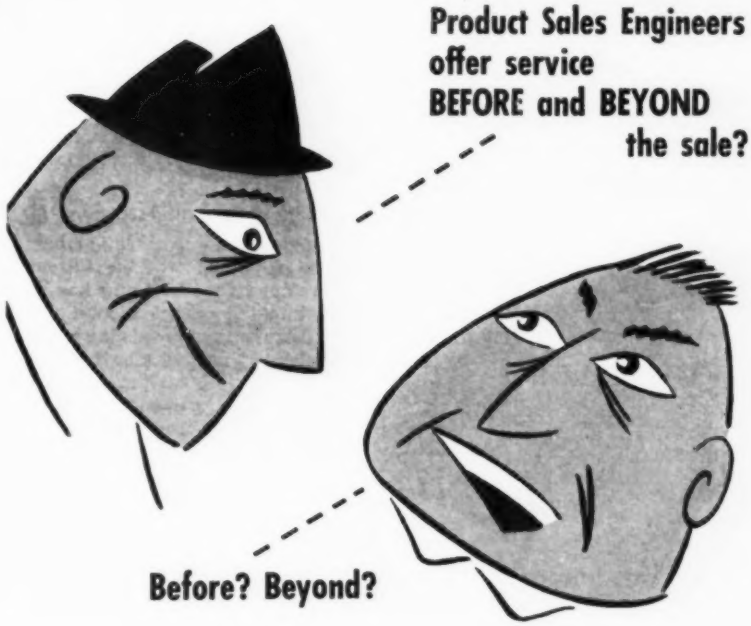
More than 5000 jobs have been created in Michigan, 1000 in Ohio, and over 200 in Indiana as a result of manufacture and assembly of Chevrolet Motor Division's new Corvair. Figures represent direct labor at Chevrolet manufacturing and assembly plants; hundreds of additional jobs have been created at other GM divisions and independent supplier companies from which Chevrolet buys other parts and components for the Corvair.

Majority of Michigan employees working on production of the small car are at Willow Run. New Chevrolet assembly plant there has a payroll of 1517; Fisher Body's adjacent plant has 2610. And the Detroit, Bay



"About the blueprint of our new jet engine for the upstairs office, Jackson. They want two more copies without cream and sugar!"

Did you know that
MID-WEST
Product Sales Engineers offer service BEFORE and BEYOND the sale?



Yes, before and beyond. That's because it takes the correct abrasive, properly installed, to meet the production requirements of both time and quality . . . and the Product Sales Engineers at Mid-West are trained to solve your grinding problems whether they be old applications, new set-ups, or quality control—AND WITHOUT OBLIGATION!

Many problems can arise even before production begins. For example, a new grinding operation is necessary in your plant, but there's no abrasive product that is perfect for that specific operation. That's the time to call on the engineering and research facilities of Mid-West. We will develop abrasive products *specifically* to your rigid requirements. We are also willing to cooperate with you on the installation of any of our abrasive products . . . and work with you as long as necessary to properly test and prove the performance of our products.

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MID-WEST ABRASIVE CO.

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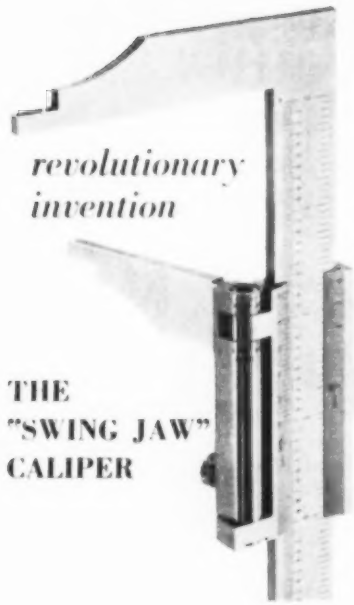
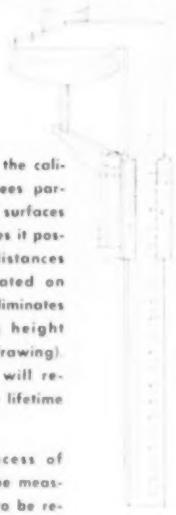


revolutionary invention

THE "SWING JAW" CALIPER

Recently perfected by a renowned Swiss designer, our patented vernier "Swing Jaw" calipers have truly revolutionary features and are precision masterpieces. Thousands are already in use in this country.



- The lower jaw of the caliper swings 180 degrees parallel to the measuring surfaces of the jaws. This makes it possible to measure distances between points situated on different axes and eliminates the need for using height gauges. (Shown in drawing). The swinging hinge will remain accurate for the lifetime of the caliper.
- Parts in the process of being machined can be measured without having to be removed from the lathe.
- Costs are greatly reduced by faster measuring.

The instrument is made entirely of stainless hardened steel. Accuracy within .001".

Model 17R — 10" size — $68.00; model 133R — 6" size — $43.00. Prices include wooden case and delivery to your plant.

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Field Report . . .

City, Flint, Livonia, and Saginaw plants have all hired new workers for production of parts and components. Facilities at Toledo and Parma, Ohio, and at Indianapolis and Muncie, Ind, have taken on 1200 new employees. Further employment gains are possible, too, says company, as production schedules are increased.

North American-Astrodyne Merger

North American Aviation has completed purchase of the full interest in Astrodyne, Inc, and has merged it into the organization. Solid propulsion operations being performed by Astrodyne will be continued at McGregor, Texas, as part of NA's Rocketdyne Division. Rocketdyne has specialized in development of high thrust liquid propellant rocket engines and has furnished units providing thrust for the Atlas, Thor, Jupiter, and other missiles for the Air Force and Army. Astrodyne has specialized in research, development, and manufacture of high energy solid propellants, boosters, gas generators, and related items.

Jessop Steel Co...

. . . Washington, Penna, producer of specialty steels, has taken over Chase Steel & Supply Co of Los Angeles, a major supplier of stainless steel used in missiles and rockets manufactured on the West Coast. Jessop will operate the company as a subsidiary and will make available immediately $1 million for Chase expansion of inventories.

Alcoa Building Die Casting Plant

Alcoa is starting work on the deferred construction of a die casting plant at Edison Township, NJ. Project, scheduled to begin in 1957, was postponed because of national business conditions. Facility, expected to begin operations in the latter part of next year, will occupy 200,000 sq ft on a 76-acre tract.

S&C Electric Co Lab

Construction of a $2 million laboratory has been started in Chicago by S&C Electric Co. It'll contain facilities for development and testing, both electrical and mechanical, of high-voltage circuit-interrupting devices. Lab initially will house a 60,000 kva short-circuit test generator and equipment for 60 c flashover testing. Later, a surge generator and a 500,000 kva short-circuit test generator will be added. All research and engineering activities, including product mock-up will be carried out in the laboratory.

Darwin & Milner Quadruples Space

Darwin & Milner, Inc, Cleveland pioneer in the development of alloyed high carbon-high chrome and cobalt-bearing steels, has moved into new quarters with four times as much space.

Atlantic Instrument Corp . . .

. . . Norwood, Mass, division of American Electronics Inc, has acquired from Westinghouse Electric Corp all designs and tools for production of gyro motors; this will broaden the line of gyro motors that Atlantic manufactures for the missile and aircraft industry.

ASTE Technical Seminars

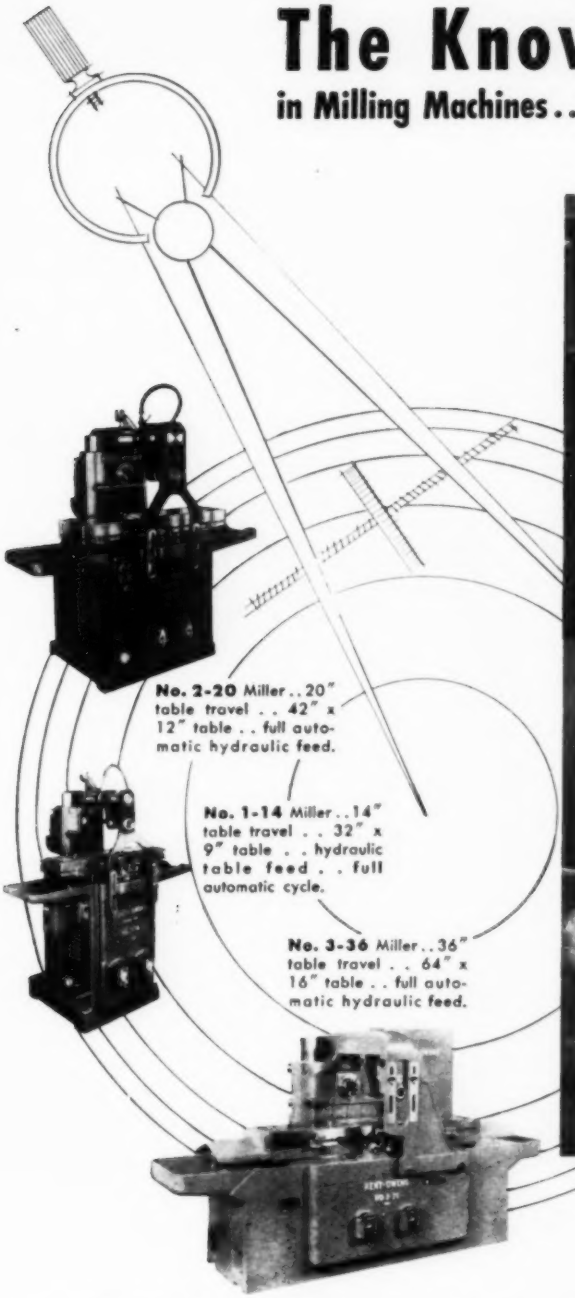
Dates and topics of the 1959-60 series of technical seminars on new methods and materials in production, tool, and manufacturing engineering have been announced by the American Society of Tool Engineers, Detroit. Each topic of the seminar has been selected on the basis of local interest and recent advances in research and industry.

"Problems of Machining Space Age Metals" will be the topic of the first seminar at the Sheraton Hotel in Philadelphia, November 17 and 18. Papers on the superalloys, which are rapidly moving from research to production, will be presented. Also

"We're just one great big happy family here, and it's got to stop."

The Know-How Dimension

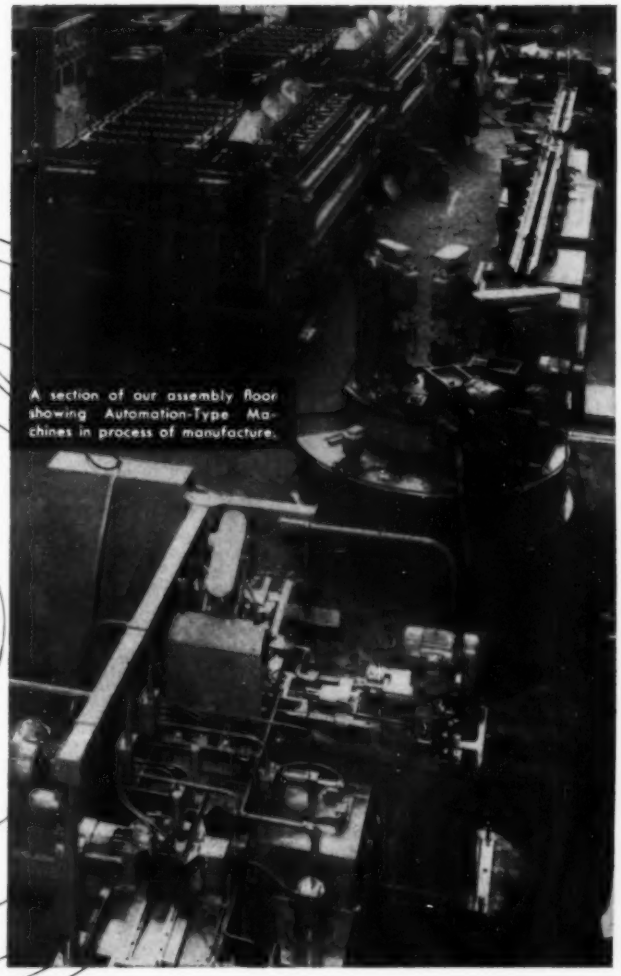
in Milling Machines . . Special Machinery . . Automation Equipment



No. 2-20 Miller . . 20" table travel . . 42" x 12" table . . full automatic hydraulic feed.

No. 1-14 Miller . . 14" table travel . . 32" x 9" table . . hydraulic table feed . . full automatic cycle.

No. 3-36 Miller . . 36" table travel . . 64" x 16" table . . full automatic hydraulic feed.



A section of our assembly floor showing Automation-Type Machines in process of manufacture.

. . makes the difference in cutting costs . . increasing production

Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards . . . is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for *answers* to their production problems.

When you are considering procurement of machinery for your milling needs . . . or seeking the solution to other production problems . . . you may wish to consider a Kent-Owens Milling Machine or a Specjal Machine designed for a distinctive and individual application. Contract Machine Building (customer designed equipment) is another of our specialties.

Write or call . . . Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

KENT-OWENS *Designers and Builders of Milling Machines and Special Machinery*

FEEDCISION

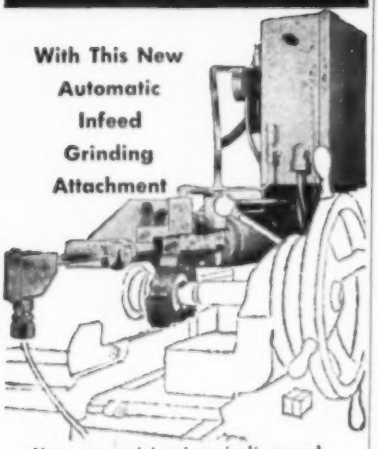
INCREASES CENTERLESS GRINDING PRODUCTION

200%

YES

300%

With This New Automatic Infeed Grinding Attachment



Utmost precision in grinding and duplicate sizing. Sizing dial is graduated in (.00001) one hundredth of a thousandth of an inch. No hydraulic checking cylinder to change feed rate when oil is cold. No checking of oil level or refilling of hydraulic checking cylinder. Three (3) different feed rates are available in one unit for the fastest, most efficient, and precise sizing in a centerless grinder.

CAN BE USED FOR TRU-FEED AS WELL AS INFEED for close sizing. Ideally located push button control station consists of Stop-Button, Caution Pilot Light, and a selector switch for set up or auto grinding positions. **CATALOG** — Write for it today!

MODERN DEVICES

Subsidiary of

TWENTIETH CENTURY MFG. CO.

Box 429 A Libertyville, Illinois

Open Territories for Manufacturers' Representatives

CIRCLE 316 READER SERVICE CARD

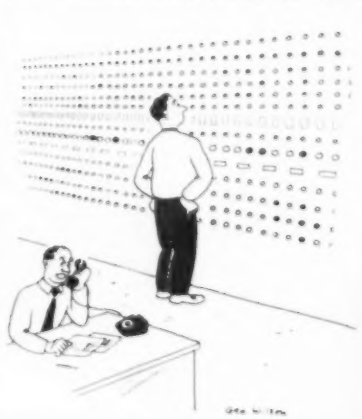
Field Report . . .

on the program are sessions on machining methods such as electro-discharge and chem-milling, as well as developments in vacuum melted castings and powder metallurgy. This will also be the subject of the San Francisco seminar at the Sheraton Palace Hotel, March 8 and 9, 1960.

Other seminars scheduled are "Metal Forming Methods for Tomorrow's Manufacturing," LaSalle Hotel, Chicago, December 3-4, Ambassador Hotel, Los Angeles, March 3-4, and Bond Hotel, Hartford, Conn, March 23-24; "What We Know Today About Metal Cutting," Sheraton Palace Hotel, San Francisco, January 28-29 and LaSalle Hotel, Chicago, May 12 - 13; "Numerical Control in Creative Manufacturing," Ambassador Hotel, Los Angeles, January 26, and Bond Hotel, Hartford, Conn, December 10, 1959; "Optical Tooling Methods in Manufacturing," Sheraton Hotel, Philadelphia, January 12; "Workshop in Optical Tooling Methods in Manufacturing," Ambassador Hotel, Los Angeles, March 1 and 2; "Automation and Your Production Program," Sheraton-Cadillac Hotel, Detroit, February 4; "Cost Reductions Through Plastic Tooling," Chase Park Plaza Hotel, St Louis, Mo, February 24-25-26; and "Dimensional Metrology," Sheraton-Cadillac Hotel, Detroit, April 21-22, 1960.

West Coast Machinists' Strike Ends

The 128-day machinists' strike against 46 metal fabricating shops has ended; representatives of union and management agreed to return to work, leaving settlement of issues to a three-man negotiating committee. About 1800 machinists struck the plants in May after rejecting a 10% hourly wage increase in two-year contracts accepted by 13 locals



"This new engineer you sent me—you know he's color blind?"

Fast Delivery

Quality

SIMONDS INDUSTRIAL CUT GEARS

★ FINISHED GEARS

★ CUSTOM GEAR CUTTING

★ HEAT-TREATED, CASE OR FLAME-HARDENED

You are sure of quality and prompt service when you place your industrial cut gear requirements with SIMONDS GEAR. We produce the full range of sizes in the types and materials you need from your blanks or ours. Let us quote on your next gear requirements.

* * *

Stock carrying distributors of Ramsey Silent Chain Drives and Couplings; and industrial V-belts.

SPUR GEARS
BEVEL GEARS
MITRE GEARS
WORMS • WORM GEARS
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Cast or forged steel, gray iron, bronze, Meehanite, rawhide or bakelite

SIMONDS GEARS

THE SIMONDS GEAR & MFG. CO.

LIBERTY at 25TH PITTSBURGH 22, PA.

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Get new-forging performance at 1/3 the cost from ERIE FOUNDRY REBUILDING SERVICE

Here at the Erie Foundry Rebuilding "Hospital", we disassemble and inspect your forging hammer, remachine worn surfaces, true bearings, replace broken parts, repair cracked parts. Once the hammer is reassembled, tested and put back in operation, it'll be as spry and sound as a new machine—but at one-third the cost!

Stands to reason that the leaders in forge manufacture for over 60 years should be the best source for forge repair.

Regardless of who made it, or how badly it's cracked, broken or worn, your forging hammer will recover most quickly at Erie Foundry's Rebuilding "Hospital". Write for the complete story.

ERIE

THE WORLD'S GREATEST NAME IN FORGING SINCE 1895

ERIE FOUNDRY CO.
ERIE 4, PA.

EF-59-OB

GEMCO

SHAPERS SAVE DOLLARS in your Machine Shop

Facts in Brief . . .

1. Powerful, rigid, efficient, dependable modern machines.
2. Tested to highest military accuracy specifications.
3. Ample safety devices, guards, convenient controls.
4. Pressure lubrication, automatic "Lubrigard" safety device.
5. Maximum range of ram speeds, table feeds.
6. Combined horizontal and vertical rapid traverses.
7. Double bull gear drives, automatically selected.
8. Smooth cutting tool action at all times.
9. Shockless clutch-brake sensitive lever control.
10. Guaranteed performance, prompt service, attractive prices.

Sizes 16" to 36" stroke in either Production or Universal Type.

GEMCO

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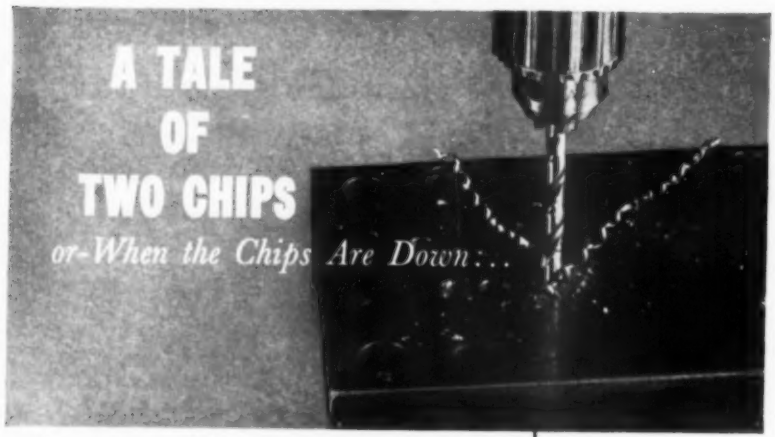
4644 Gravois Ave.
St. Louis 16, Mo.

Founded in 1917

CIRCLE 319 READER SERVICE CARD



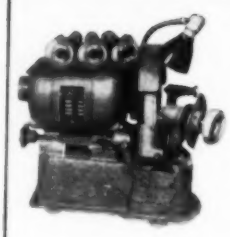
Do you get more holes per minute • longer drill life • closer tolerance holes • less operator fatigue?

Equal size chips mean you are getting these results from your drills.

Hand sharpened drills should produce equal size chips . . . but only after time-consuming work by an expert. Now, with the Black Diamond Drill Grinder*, anyone in your plant can do the job with repeat accuracy in just a few seconds. Get the facts by return mail. Write exclusive distributor:

EDWARD BLAKE COMPANY, INC.
Dept. 4, 570 Pleasant St., Watertown, Mass. WA 6-0100

*Black Diamond Saw & Machine Works, Inc.
Natick, Mass.—Manufacturers of Black Diamond and Worcester Drill Grinders.



BLACK DIAMOND DRILL GRINDERS: For #70 drills up to ¾ (Illus.)

WORCESTER DRILL GRINDERS: For ⅛" drills up to 2½"

CIRCLE 320 READER SERVICE CARD

Field Report . . .

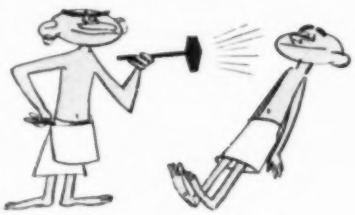
of other unions whose members work in the shops. The machinists asked for a 12% increase and other benefits.

Sylvania Electric Products . . .

. . . has bought a 29,000 sq-ft plant in Manchester, NH for manufacture of transistors. It'll employ from 800 to 1000 workers within the next two years.

MEMOS

by BESS RITTER



Many African tribes consider their blacksmith to be just a little bit better than the average citizen. His hammer is supposedly endowed with all kinds of magical and spiritual powers. If he accidently points the hammer at an individual, it is believed this person will die.

The only way to prevent this mishap is to kill a goat and cut two finger rings from the animal's skin. One must be worn by the smith, on the middle finger of his right hand. The other must be donned by his inadvertent victim, on his corresponding finger.

If a lady named Mary Rooney had had her way, we'd be carrying our own beds along with us when we travel—and the bed itself would look like a typical trunk of the 1885 period. This was because she invented such a bed. It was a square affair, with handles at the sides and a big lock in the middle, only it (supposedly) contained bedclothes instead of garments.

The bottom of the trunk was pushed upwards and the two long sides remained on the floor, forming supports. The short sides of the trunk were attached to the bottom of the trunk by piano hinges and swung down to lengthen the bed. The lid split across the center and swung down with the sides to become the head and foot boards.

CIRCLE 321 READER SERVICE CARD ►

ANNOUNCING

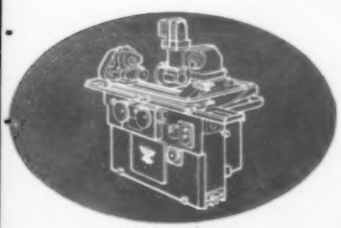
MICRO MATIC
HONE CORPORATION
DETROIT, MICHIGAN

MANUFACTURED BY
JONES-SHIPMAN
LEICESTER, ENGLAND

Micromatic Hone Corporation is now the exclusive sales and service source in the United States and Canada for grinding machines manufactured by its associate, A. A. Jones & Shipman of Leicester, England. Jones-Shipman has been building and selling Micromatic equipment overseas since 1950. The outgrowth of this close association between the two leading companies in their respective fields . . . now links the precision Jones-Shipman line to Micromatic coverage.

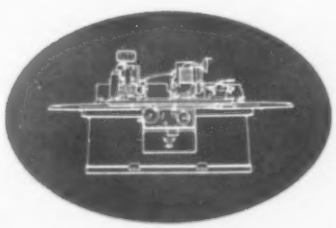
The experience and reputation for top quality and highest reliability, that Micromatic has gained in selling Microhoning equipment to the metal-working market for over thirty years, is now also behind every domestic sale of these superior grinders. Complete performance-and-service satisfaction on every Jones-Shipman grinding machine is guaranteed by Micromatic.

The designed-for-precision features of these grinders invite competitive comparison. Their performance over nearly half a century has resulted in Jones-Shipman products earning a world wide reputation. Basic details concerning their designs, applications and performance characteristics are found on the following pages.

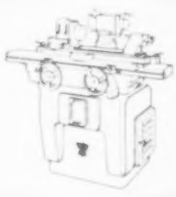


MODEL 1014
Universal Toolroom Grinder

MODEL 540
Hydraulic Surface Grinder

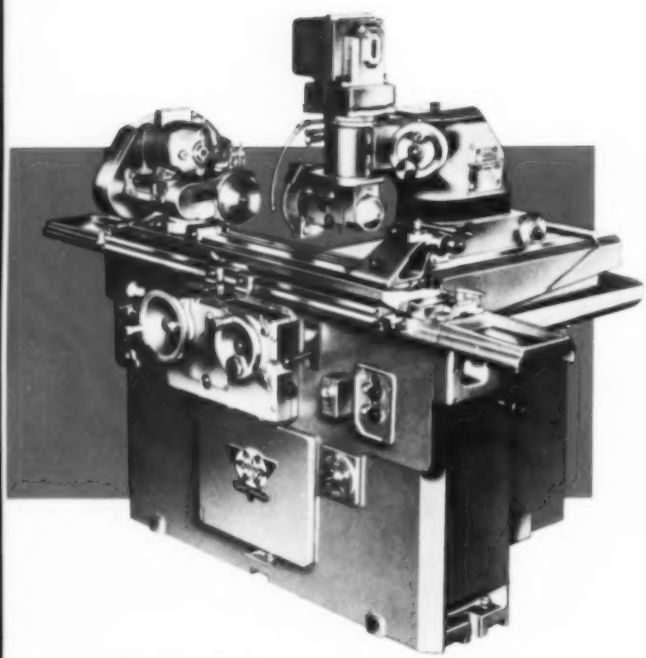


MODEL 1305
Precision Grinder



MODEL 310
Cutter and Tool Grinder

HERE ARE GRINDERS THAT
for Precision, Durability, Range of



MODEL 1014
UNIVERSAL TOOLROOM GRINDER

This 1014 Universal Tool Room Grinder is designed to give extra-ordinary sensitive control that results in *high quality external and internal grinding.*

Wheelhead is of a special type. It has deep throat capacity and wheel position is centralized in relation to table. This permits surface grinding (using hand cross-transverse) and offers special facilities for broach grinding.

The extra Universal Cutterhead extends the versatility of this highly accurate machine to cover tool and cutter grinding.

FEATURES:

Hand cross-feed and vertical-feed in .0001″ increments • Automatic cross-feed per reversal of table of .0001″ to .007″ over .025″ (reduction in work diameter of .050″). • Automatic table traverse, 4 speeds provided. Micrometer adjustment to table traverse in .001″ divisions. • Wheelhead saddle on anti-friction mountings. Long vertical roller slides provide complete support of wheelhead in all positions. • Precision built wheelhead motor on anti-vibration mountings. • Wheel spindle unit swivels full 360°. Five external grinding wheel speeds. • Grinding wheels fitted on either end of wheel spindle. Nitralloy spindle runs in plain bearings. • Vernier scales to wheelhead and table swivels. • Fast cross-traverse to wheelhead for setting purposes.

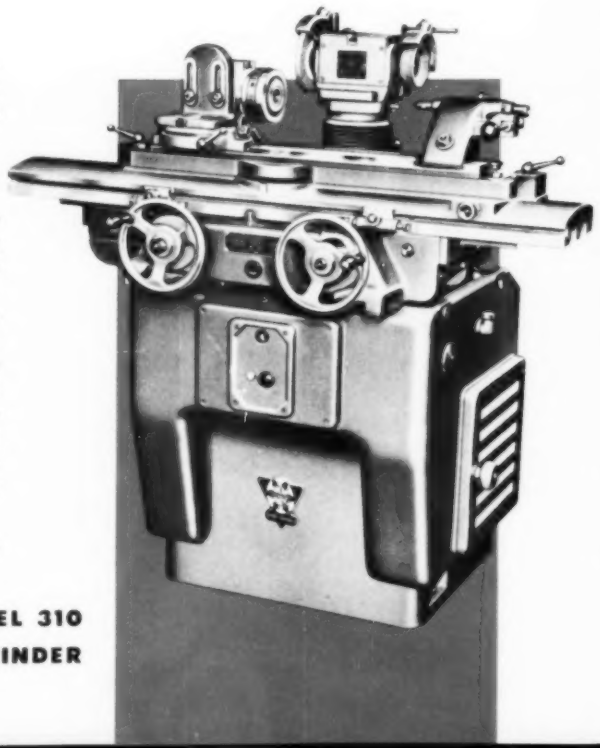
For additional information, send for Micromatic Bulletin 206Q.

The 310 Cutter and Tool Grinder is designed to efficiently perform a wide range of grinding operations. Thus, tools and cutters can be ground in shortest possible time to keep production costs at a minimum.

FEATURES:

Universal operating positions—all within comfortable reach of operator. • Anti-friction cross saddle mounting assures sensitive control to cross feed. • Table traverses on precision roller chains, giving "fingertip" control. • Table dogs reversible—one end spring loaded and the other a dead stop. • Table swivels a full 90 degrees in left-hand direction and 45 degrees right-hand. • Large diameter wheel spindle, mounted on specially selected preloaded bearings. • Universal Cutter Head adjustable to swing from 8″ to 12″ diameters. • Cutter Head and Tailstock provided with clearance angle setting adjustments. • Attachments available to cover a wide range of tool and cutter grinding operations.

For additional information, write for Micromatic Bulletin 139W.



MODEL 310
CUTTER AND TOOL GRINDER

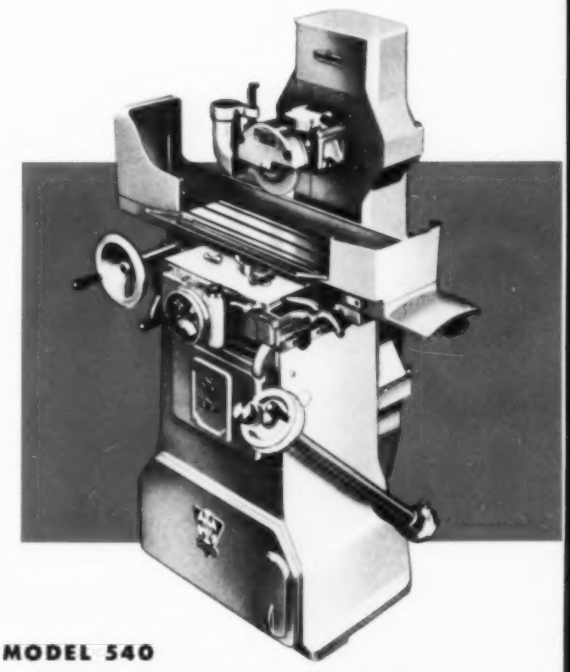
INVITE ANY COMPARISON
Operations, and Grinding Efficiency

The 540 Surface Grinder (6″x 18″ capacity) has more than just the essential qualities required to provide high caliber surface grinding. Its simplicity of design provides ease of operation while inherent accuracy and efficiency assure excellent grinding performance. Thousands of these grinders have been purchased by discerning users in every part of the world.

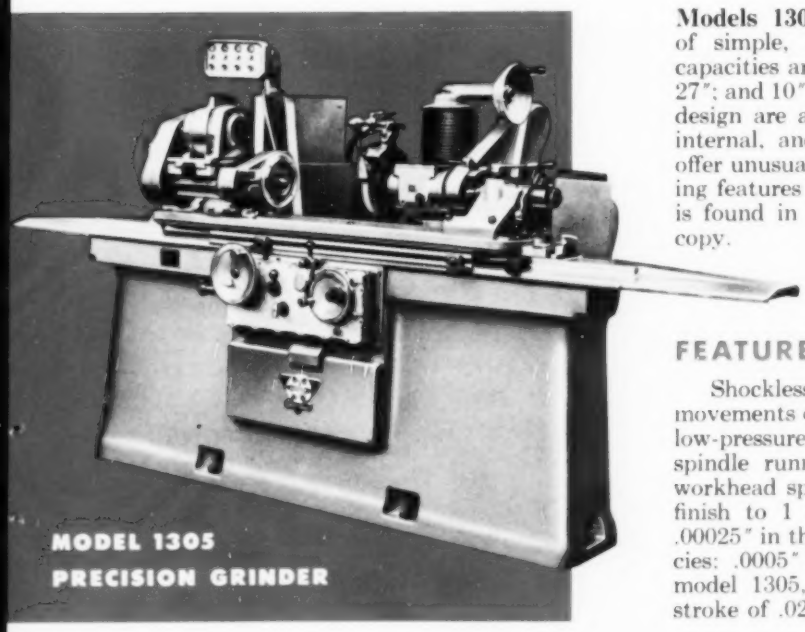
For additional information, send for Micromatic Bulletin C183.

FEATURES:

Completely centralized controls within easy reach of operator. • Patented low-pressure, long-life Hydraulic System operating from self-contained motor driven pump unit. • Table traverse rates variable from 5 to 40 feet per minute. Smooth and shockless reversing at maximum speeds. • Cross-feed automatically variable from .01″ to .07″ per stroke. • Hand controls provided for both traverse and cross-feed. Micrometer adjustment to cross-feed in .0001″ divisions. • Vertical adjustment of wheelhead controlled by conveniently placed handwheel having a micrometer knob adjustment in .0001″ divisions. • Wheelhead slide operates on ball bearing rollers running on precision ground bars, providing absolute sensitivity of vertical feed. • Automatic vertical wheelhead feed and electric lift (can be fitted as extra features). • Numerous attachments, including form tool grinding equipment, are available to assure full versatility.



MODEL 540
HYDRAULIC SURFACE GRINDER



MODEL 1305
PRECISION GRINDER

Models 1300, 1305 and 1310 precision grinders are of simple, accurate, and rugged design. The three capacities are: 8″ swing and 18″ between centers; 10″ x 27″; and 10″ x 40″. Several types of wheelheads of proven design are available. For external cylindrical or taper, internal, and cutter and tool grinding, these grinders offer unusual efficiencies. Additional information regarding features and accessory equipment for these grinders is found in Micromatic Bulletin 208M; send for your copy.

FEATURES:

Shockless table reversal at all speeds. • Micrometer movements on table and cross-traverse. • Trouble-free, low-pressure hydraulic system. • Nitralloy wheel spindle running in plain bearings. • Super-accurate workhead spindle in selected plain bearings. • Surface finish to 1 microinch. • Parallel grinding to within .00025″ in the center over 24″. • Table reversal accuracies: .0005″ for models 1300 and 1310, and .001″ for model 1305, at maximum table speeds. • Minimum stroke of .020″ at maximum table speed.

AN UNBEATABLE COMBINATION . . .

MICROMATIC
SALES AND SERVICE

Since 1929, Micromatic has been constantly expanding every phase of its operation—plant, research, products, sales and services. And, the same unusual sales-engineering service that has typified Micromatic marketing activities for over thirty years, is now applied to the selling and servicing of these grinders. Specifically, Micromatic accepts full responsibility for every installation. Both the grinding machines and results obtained are guaranteed.

MICRO MATIC
HONE CORPORATION
DETROIT MICHIGAN

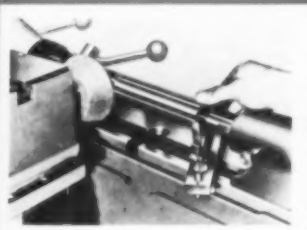
MANUFACTURED BY
JONES-SHIPMAN
LEICESTER, ENGLAND

MANUFACTURED BY
JONES-SHIPMAN
LEICESTER, ENGLAND

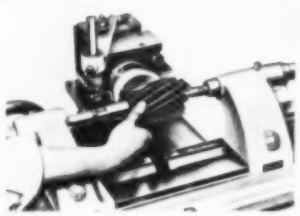
JONES-SHIPMAN
DESIGN AND MANUFACTURING

Jones & Shipman started business in 1898 and has been designing and manufacturing grinders since 1910. They maintain a continuous research and development program that is designed to keep their grinders ahead of the industry in all phases of operation and application. Manufacturing facilities are all modern and skilled personnel with years of experience—twenty-five percent of their employees have twenty or more years of service—assure highest quality workmanship.

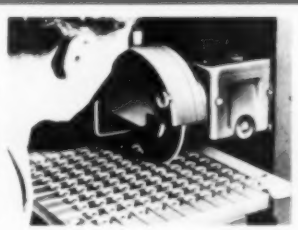
. . . FOR GRINDING APPLICATIONS LIKE THESE



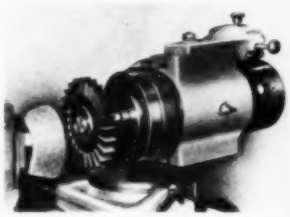
Grinding reamers—toothrest provides indexing.



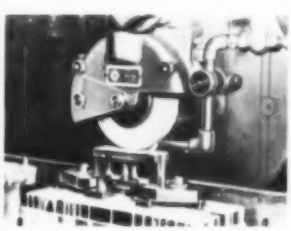
Grinding a cutter—indexing finger is set to tooth spiral.



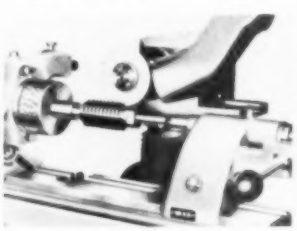
Grinding grooves in mold for miniature rubber tires.



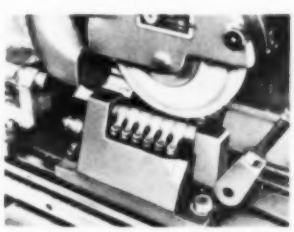
Grinding the side faces of a side and face milling cutter.



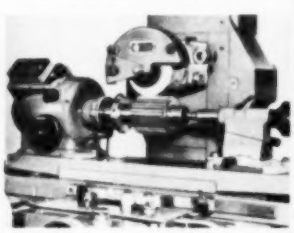
Grinding gun-metal gate brackets for projectors.



Grinding the flutes of hob—indexing attachment is used.



Form grinding the pad faces on valve rocker arms.



Optical dividing—finest reading is 6 seconds of arc.

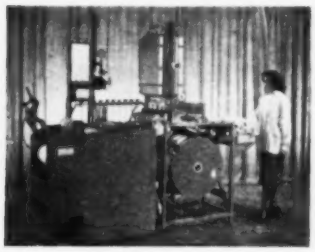
MICROMATIC HONE CORP.

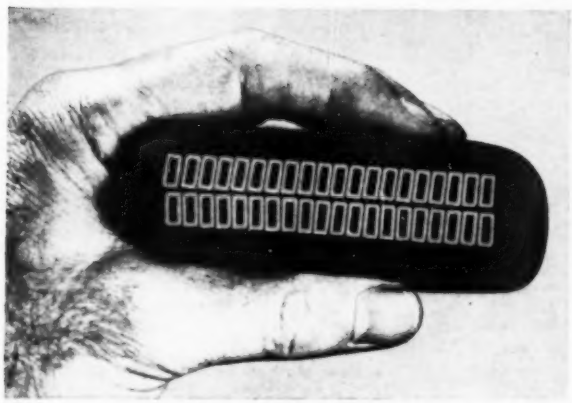
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

FOR ADDITIONAL INFORMATION,
write for literature that completely describes each grinder.

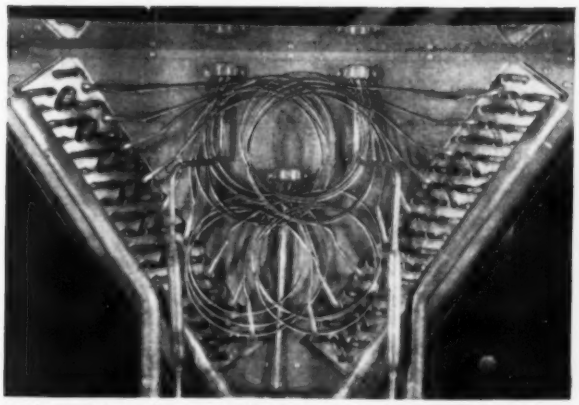
BETTER WAYS of doing things with seamless copper tube are unlimited—from capillary sizes to 26-inch diameter—round tubes or special shapes.

A better product faster. In the Kodak Roll Paper Dryer-Glazer shown below, photographic print paper travels around a heated, mirror-smooth, chromium-plated copper drum. This drum could be formed from sheet metal, welded and ground. But Eastman Kodak Company takes a production short cut and buys the drums ready made—Anaconda seamless copper tube 26" inside diameter, in wall thicknesses of ⅛", cut to 20" lengths. Having the thermal conductivity and corrosion resistance needed, the tube is also easy to polish to a high mirrorlike finish (photo, left), provides an excellent base for fine chromium plating. No seams mar the surface. Production time and steps are cut.





Rectangular copper tube carries current and coolant. By liquid cooling conductors in generator stator bars, General Electric has opened the way to doubling generator ratings without appreciably increasing frame size. Tubes, approximately 0.300" x 0.130" O.D., shown in cross section above, are shipped in long coils. Special-shape tubes are available in a wide variety of sizes, cross sections, and alloys.



High-precision tubes meter fluids. York Corp., subsidiary of Borg-Warner, has found restrictor-tube metering of refrigerant in packaged air-conditioning units up to 25-ton capacity has greatly reduced field service, made possible the 5-year protection plan on all units. Anaconda Copper Restrictor Tubes have consistently met York's strict requirements. These tubes are available in copper or aluminum in nominal I. D.'s from .025" to .090".

WHETHER you need long lengths of copper capillary tubing for air, hydraulic, or lubricating lines or for instrument tubing—or large-diameter tube in copper or a copper alloy, call your American Brass Company representative. He can help you select the product you need from the broadest range of seamless tubes available to industry. Or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

2043

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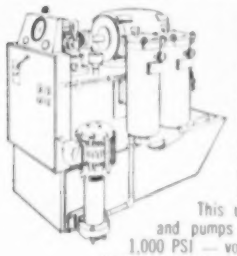
GUN DRILLING ACCESSORIES help you

DRILL FINISHED HOLES IN ONE PASS

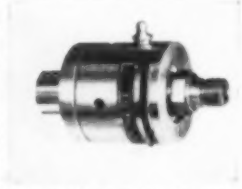
Adapt your present equipment for modern gun drilling with these specially designed gun drill accessories.



the original HI-PRESSURE COOLANT SUPPLY UNIT

The heart of any gun drilling operation is proper coolant in generous quantities. This unit filters, cools and pumps at pressures to 1,000 PSI — volumes to 40 GPM (higher capacities available).

END ATTACHED COOLANT TRANSFER



Attached to the outboard end of hollow-spindle equipment to transfer coolant to the rotating gun drill. Pressures to 1,000 PSI and speeds to 10,000 RPM.

GUN DRILL ADAPTOR
Not illustrated—for solid spindle equipment. The coolant transfer is integral with the adapter spindle.

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MACHINES AND ATTACHMENTS

1 EXTRA HEAVY-DUTY ENGINE LATHE—*Sidney Machine Tool Co, Sidney, Ohio.* 4-page illustrated bulletin S-601 gives facts on design, features, and performance of new Sidney 4025 with 36 spindle speeds in range of 5 to 800, 75 hp in all speed ranges; bed, 33 in. wide x 22 in deep, up to 49 ft long; swing over bed, 40½ in. dia; swing over compound, 25½ in. dia. Model is available in two increased swing capacities.

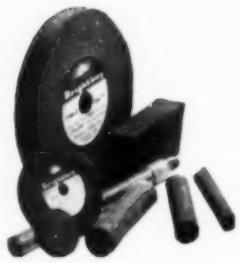
2 UNIVERSAL INTERNAL GRINDING MACHINE—*Heald Machine Co, 11 New Rand St, Worcester 6, Mass.* 8-page bulletin 2-273A-1 illustrates and describes design features applications, specifications, and accessories of new Model 273A high precision unit for internal, external, and rotary surface grinding. It will process straight or taper bores, ODs, flat, convex, or concave surfaces, and is particularly useful where internal grinding of a variety of single parts or small lot production is required.

3 OBI MECHANICAL GAP PRESSES—*Oliver Corp, A B Farquhar Division, 120 N Duke St, York, Penna.* 12-page bulletin M-1000 contains illustrated description of construction and operating advantages of the Oliver-Farquhar OBIs; includes data on the two Series that are available in 75, 110, 150, and 200-ton capacities. The 1000 Series is equipped with an air-operated friction clutch mounted on the back shaft; the 2000 Series has clutch mounted on the crankshaft. Detailed specifications included.

4 HYDRAULIC PRESS BRAKES — *Niagara Machine & Tool Works, 681 Northland Ave, Buffalo 11, NY.* 4-page bulletin 91 describes new line that includes 44 models in 200-1000 ton capacities. Selection chart shows essential differences between mechanical and hydraulic brakes in use, tonnage, stroke, speed, accuracy, and ram adjustment. Complete specifications and die space dimensions included.

5 HYDRAULIC SURFACE GRINDER —*Carel Manufacturing Co, Benton Harbor, Mich.* 4-page bulletin 10H9 contains illustrated description of No. 10-H,

"Well, that's the last time he'll fall asleep at his desk."



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proven design features . . .

Here is the second in the entirely new, field-tested line of heavy duty Nebel Lathes, extending Nebel economies even further into the heavy duty field

The rugged, proven design Nebel Model 2516 Engine Lathe is built to the complete A.S.A. standards and tolerances of accuracy for engine lathes. It offers you more accuracy, more power, more and higher spindle speeds than ever before available from Nebel.

- Heavy duty 3-bearing spindle with zero precision bearings.
- 18 spindle speeds through complete gear range . . . up to 1500 RPM . . . streamlined speed selection.
- 60 feeds, 60 thread changes . . . all directly read.
- Automatic lubrication.
- Wide design carriage with 146 square inches of bearing surface on bed ways.
- Double-wall one piece totally enclosed apron with simplified controls.
- End gearing totally enclosed in self-lubricating housing.
- Power traverse heavy duty tailstock with rugged thrust lock.
- Rigid box girth design bed . . . hardened and ground steel bedways.

Write for new, fully descriptive Bulletin No. 213.

Nebel Lathe Division • Nebel Machine Tool Corp.
3407 Central Parkway, Cincinnati 25, Ohio

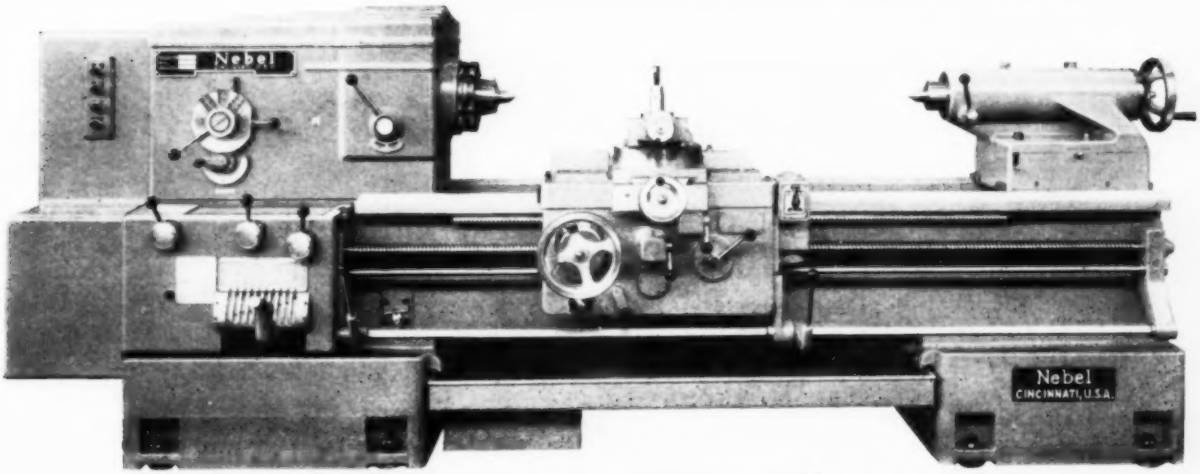
Other entirely new, proven design Nebel Lathes now available:

- Heavy Duty Model 2013 (Bulletin 212)
- Standard Duty Model 2516-20 (Bulletin 214)
- Heavy Duty Extension Bed Gap Lathe Model HXB 26/45 (Bulletin 211)

NēBEL

HEAVY DUTY ENGINE LATHE

entirely new, proven design



NEBEL MODEL 2516 HEAVY DUTY ENGINE LATHE

My George was like that...

He used to be unfit to live with until they started having their gears made to order by CINCINNATI GEAR. And now young George is having the same experience at his place. Mary just invited me for a visit—she says their home is such a happy one now.

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a 6 x 18-in. unit with 16½-in. vertical capacity under 7-in. grinding wheel. Hydraulic power feed unit is direct-driven by ½-hp 3450-rpm motor. All specifications tabulated; attachments described.

6 PLUNGE PRODUCTION GRINDER — *Landis Tool Co, Waynesboro, Penna.* 4-page bulletin RP-59 describes and illustrates new Landis R unit, a single-purpose grinder for use in plants where high production is required to extremely close tolerances. Features of machine pictured; sketches of typical work setups included as well as condensed specifications.

7 HEAVY-DUTY BANDSAW—*Henry G Thompson & Son Co, Milband Machine Tool Division, New Haven 5, Conn.* 5-page bulletin, Form 502-59, presents detailed information on the Milband bandsaw machine tool, equipped for fully automatic operation. Outlines advantages that bandsawing with HSS band blades offers over other cutoff methods. Features include 22-in. blade wheels; blade twist of only 30°; 15½-in. pivot span; and a wide range of infinitely variable speeds. Includes specifications and tables showing comparative cutting times and other performance data.

8 SMALL PRESS BRAKES—*Dreis & Krump Manufacturing Co, 7400 S Loomis Blvd, Chicago 36, Ill.* 4-page bulletin S-59 illustrates and describes two light-duty models of mechanical press brakes. Features and specifications covered for Model 131, 11-ton capacity, and Model 265, 25-ton capacity units.

9 LIGHT - HEAVYWEIGHT MACHINE TOOLS—*Rockwell Manufacturing Co, Pittsburgh 8, Penna.* Revised 48-page catalog describes new tools and accessories added to the Walker-Turner metalworking line. These include a 17-in. drillpress, 2½-in. belt grinder; and a 20-in. bandsaw, and butt welder.

10 "AVOIDABLE COSTS" REPLACEMENT FORMULA FOR MACHINE TOOLS—*Jones & Lamson Machine Co, Springfield, Vt.* Revised second edition of 12-page booklet describes method for appraising the productivity of machine tools and similar capital equipment. Incorporates new projection factors for use as

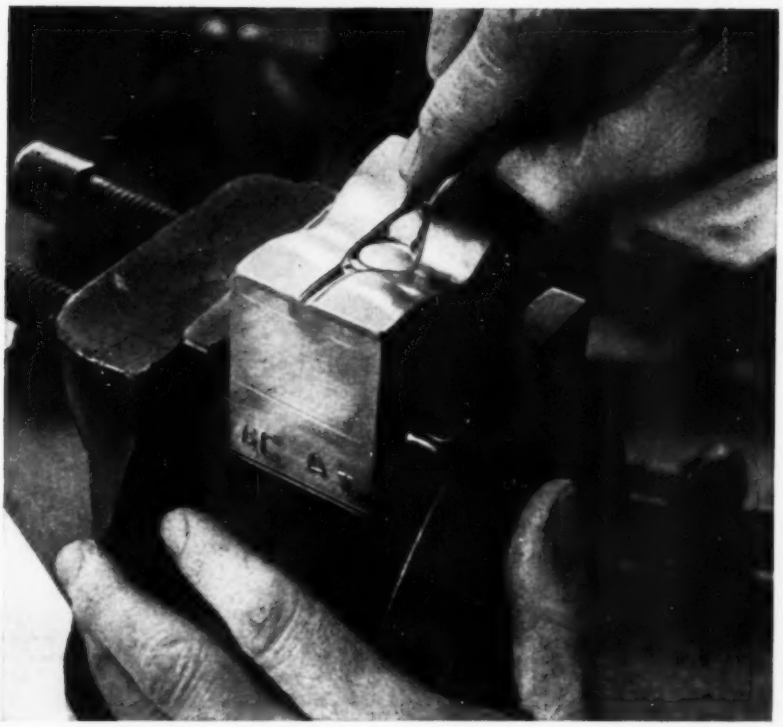
(continued on p260)

"Shirley gypped me on this one."

Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



BEARCAT EMBOSSES INTRICATE GOLD

10k gold strikings for class rings no problem for this outstanding shock-resisting tool steel

Bearcat tool steel is performing brilliantly at The Metal Arts Co., Inc., Rochester, N. Y., where it is used in embossing 10k gold ring shanks and bezels for high school and college class rings. Bearcat was suggested by our local tool steel distributor, The Burke Steel Co., Inc., Rochester.

"Of course there are other grades which might be satisfactory," the Burke representative told them, "but what you are looking for is outstanding shock-resistance. Put Bearcat to work in this job and you'll never be sorry."

At last report, the dies were bearing out the prophecy. Hardened to Rockwell C-58-59, and operating in drop hammers, they had turned out thousands of the intricate gold strikings, without any sinking or breaking.

Bearcat, our super grade of shock-resistant air-hardening tool steel, takes shock jobs in stride, and has superior wear-resistance. And because it's air-hardened, Bearcat minimizes quenching hazards and distortion in heat-treatment.

Next time you're looking for a really tough tool steel, team up with Bearcat. You'll be glad you did.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Stainless Is Tough On Tools

Many items formerly made of soft steel are now being made of stainless steel. The austenitic stainless steels (AISI 300 series) are popular because of their corrosion-resistance, plus their strength and oxidation-resistance at moderately high temperatures.

Whenever stainless parts are made with tools formerly used on soft steel, there is a marked decrease of production of parts per tool. For example, on a simple blanking operation on stainless steel, the production per grind on the punch and die usually is about one quarter of the production on soft steel.

Though it is rarely possible to change conditions so that the "normal" tool life can be realized when making stainless parts, some improvements can be made. For example, if the blanking tools were originally made of AISI W1 water-hardening or O1 oil-hardening tool steels, a change to D2 high-carbon, high-chromium tool steel is suggested. This change will improve the tool life from two to three times. Or if D2 high-carbon, high-chromium tool steel is already being used, it may be necessary to carburize, or to nitride, in order to improve the wear-resistance. Close attention must be paid to mechanical conditions, such as proper clearance between punch and die, proper penetration of the punch, and optimum grinding procedures in finishing the tools.

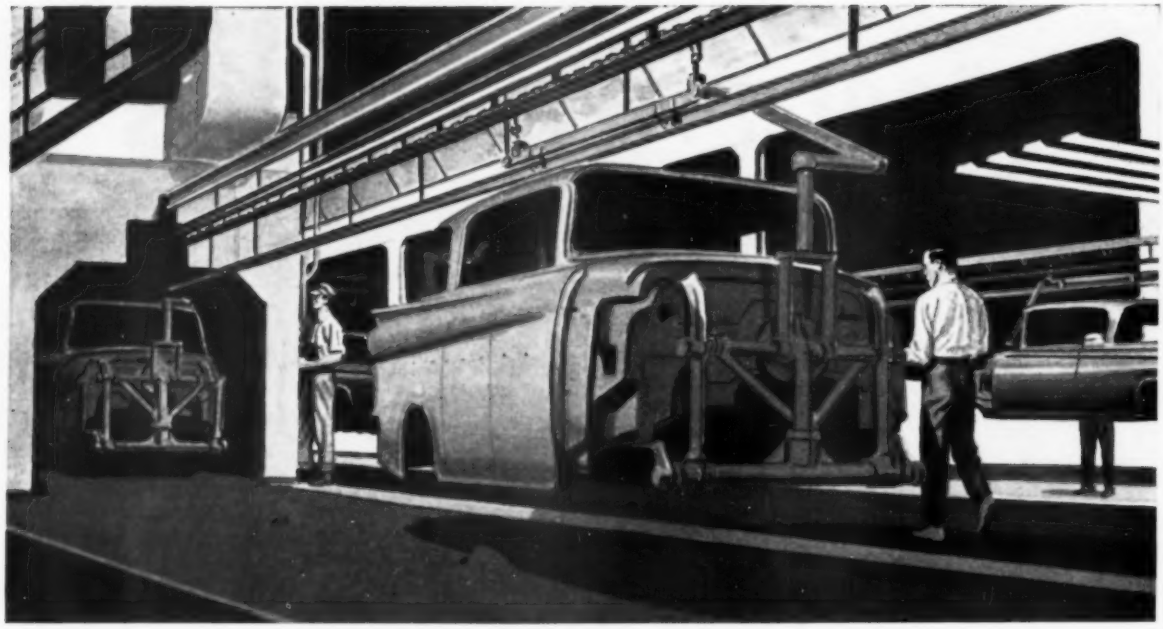
Because stainless is tough on tools, careful planning is necessary for good tool life.

Write for

BETHLEHEM TOOL STEEL LITERATURE

If you would like to have booklets on our tool steel grades, just check your choice below, and mail to Room 1041, Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

- ☐ Hot Work
- ☐ High Speed
- ☐ Carbon and Carbon-Vanadium
- ☐ Shock-Resisting
- ☐ Hollow Bar
- ☐ Oil and Air Hardening
- ☐ Special Purpose
- ☐ Lehigh H (high-carbon, high-chrome)
- ☐ Bearcat
- ☐ Tool Steel Selector



In the automotive industry alone, there are 30 Cold Bonderite installations.

How Cold Bonderite System cuts costs

Some actual user-experiences of savings in heat requirements, maintenance, water and electricity, and equipment after installing Cold Bonderite System.

Less than two years ago, the first public announcement of Parker's Cold Bonderite System was made.

Now, well over a hundred plants are using this revolutionary, money-saving system of phosphate-treating at low temperatures.

Some are among the country's largest plants, others are quite modest in size and production. Products treated range the list from automobile bodies to small appliance components.

From these users we have compiled a long list of documented savings records. In many cases, cost reductions have been greater than we had hoped to achieve.

The temperature tells the story! Cold Bonderite System solutions operate 60° to 75° cooler.

Heat Saved

The greatest percentage savings in heat requirements (90%) has been reported by an automotive plant. Before installing Cold Bonderite System, the finishing line used 50,000 pounds of steam an hour. Cold Bonderite in the line uses only 5,000 pounds per hour.

In another auto plant, heat savings are figured at 74% on a body line. A small parts finishing line in the same plant shows the same percentage reduction in heat requirements.

A manufacturer of metal cabinets reduced gas consumption for heating his phosphating line from 33,000 to 14,000 cu. ft. per day—a 56% reduction—by installing the Cold Bonderite System.

A famous maker of household equipment changed from conventional phos-

phating to Cold Bonderite System and saw his steam use plummet 66%.

Another manufacturer, an Eastern small appliance maker, reports that on gas expense alone he has cut his phosphating costs 45%.

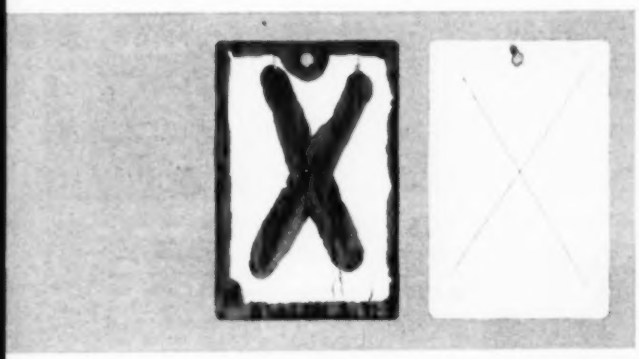
Other Savings Pile Up

The magnitude of other savings, beyond heat consumption, has been surprising to users and very good news to their cost accounting departments.

Electricity, for instance. At the greatly reduced temperatures of the solutions, there is no need to operate exhaust fans. In one installation, the change to Cold Bonderite eliminated the need for replacing a $15,000 exhaust system.

Water use is reduced about 25% because there is less evaporation.

Maintenance costs nosedive with Cold Bonderite System in the finishing line. Lower temperatures in the heating coils mean less frequent—or no necessity for—cleaning the coils. When there is service to be performed, the maintenance crew can move right in without waiting for the installation to cool off.



Comparative 48-hour salt spray test proves performance. Left, untreated panel; right, panel Cold Bonderite-treated before painting.

One user figures that he has eliminated 364 manhours of maintenance time yearly with his Cold Bonderite System.

The same manufacturer has discovered, too, that the reduced temperatures have allowed him to eliminate a number of steam traps and steam coils costing over $8,000.

Coating Quality Is High

While Cold Bonderite System is saving money on the phosphating line in these many ways, there has been absolutely no diminution of quality in the coatings or their performance.

The Bonderite coating produced by low-temperature Cold Bonderite System matches the high standards set by Bonderite for thirty years. In salt spray, humidity and outdoor exposure tests, as well as in actual service on automobiles, appliances, furniture and many other products, performance has been proven.

Results are uniform hour after hour and day after day. Control and operation of the system is simple and practically foolproof.

Chemical Costs Held Low

All the savings attained by the use of Cold Bonderite System are *real* savings. They show up on the P & L statement because *chemical costs for this revolutionary development are not increased.* The special Bonderites and Parco Cleaners are strictly comparable to conventional hot treatments in the cost of treatment per square foot.

Only Parker Has Cold System

There is, actually, no other system like it. Cold Bonderite System was developed by Parker research, tested and perfected by Parker chemists. It has been proven over and over again as the way to get superior phosphate coatings on steel with spectacular savings.

The Parker representative in your territory is ready to advise and work with you to change your phosphating installation over to Cold Bonderite System. Call him in or write direct to Parker, Detroit.

**Bonderite, Bonderlube, Parco, Parco Lubrite – Reg. U.S. Pat. Off.*

PARKER RUST PROOF COMPANY

2196 E. MILWAUKEE, DETROIT 11, MICHIGAN

BONDERITE corrosion resistant paint base | BONDERITE and BONDERLUBE aids in cold forming of metals | PARCO COMPOUND rust resistant | PARCO LUBRITE—wear resistant for friction surfaces | TROPICAL—heavy duty maintenance paints since 1883

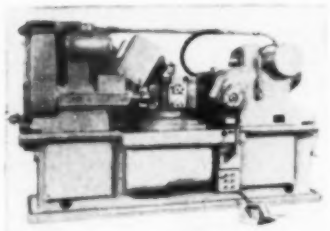
ALL ENDS OF PARTS
Completely Finished
"1·2·3"
ON THE
GOSS *and* DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

This recent Gross & DeLeeuw development has already received universal acclaim as an outstanding achievement.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages also apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.



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a guide in the analysis of capital equipment replacement problems. Worksheets are supplied with the booklet.

11 ELECTRONIC OVERLOAD DETECTOR FOR PRESSES — *Wintriss, Inc, 20 Vandam St, New York 14, NY.* 4-page bulletin provides information on the Circuit Master Mark III that operates automatically to eliminate die damage due to overload, misfeed, buckling, or similar malfunction. By directly measuring normal die shut height, unit senses any change and immediately stops the press before the die strikes again.

12 STEELWELD HYDRAULIC SHEARS—*Cleveland Crane & Engineering Co, 1058 East 289th St, Wickliffe, Ohio.* 15-page illustrated catalog 2030-A describes new line with pivoted-blade action. Provides construction details and specifications on units available in all sizes for cutting metal in lengths to 30 ft and in all thicknesses to 2 in.

TOOLS AND ACCESSORIES

13 OPTICAL EQUIPMENT—*Keuffel & Esser Co, Adams and Third Sts, Hoboken, NJ.* 25-page illustrated catalog covers complete K&E line of equipment for production tooling, machine alignment, quality control and inspection, including jig transits, alignment telescopes, collimators, sight levels, and a line of sight telescopes. Technical descriptions and specifications provided.

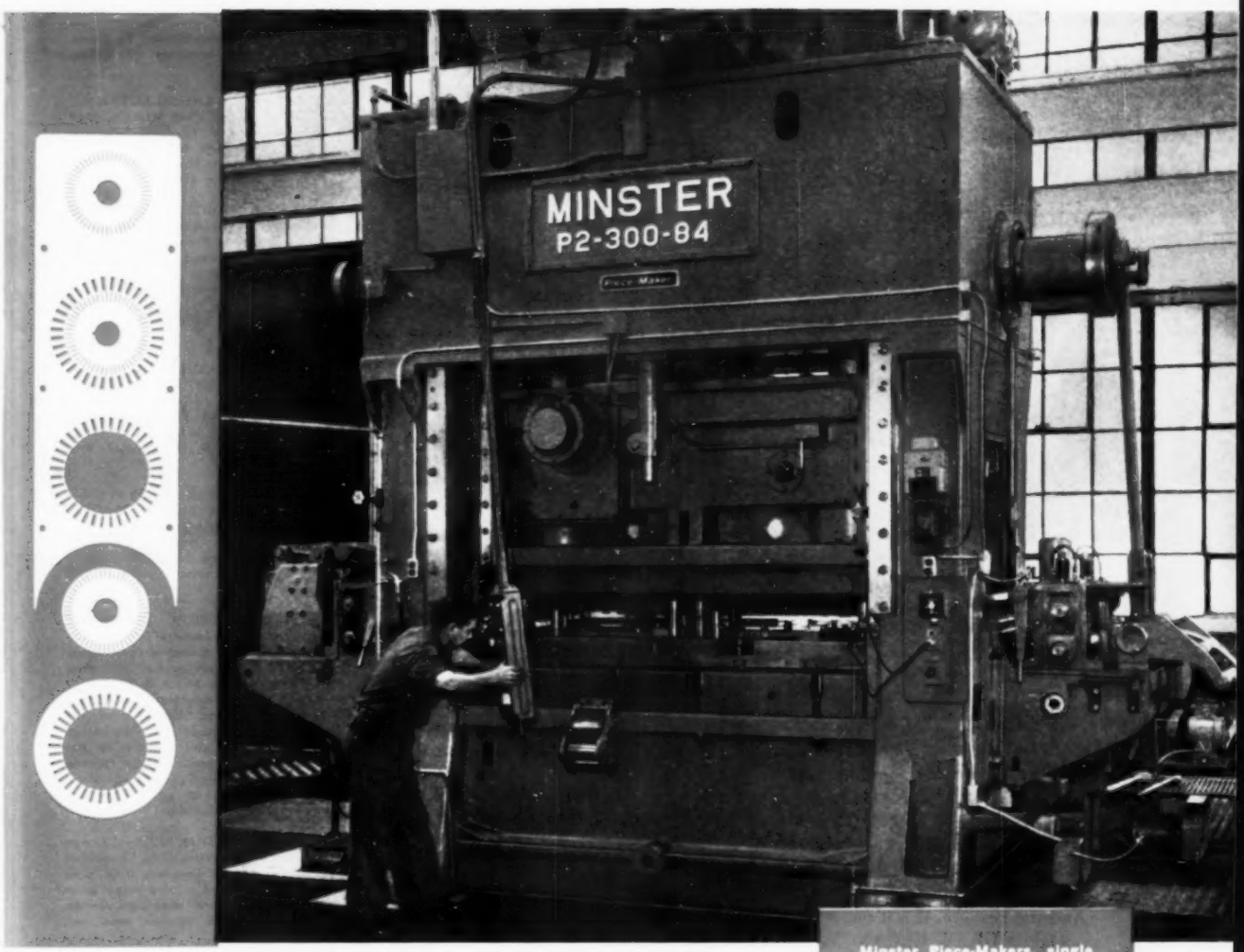
14 ASSEMBLY AND RUN-IN LUBRICATION—*Acheson Colloids Co, Port Huron, Mich.* Illustrated bulletin 421 discusses problems involved and methods of overcoming them. Cites 10 reasons why use of Acheson colloidal lubricants are superior in such operations.

15 INDUSTRIAL SAWS AND CUTTING TOOLS—*Disston Division, H K Porter Co, Philadelphia 35, Penna.* Four new catalog sections available include a 32-page solid and inserted tooth circular saw section that contains proper selection data, lists most popular tooth styles for various types of saws. Other sections cover wide and narrow bandsaws, metal-cutting saws, and machine knives.

16 ELECTRONIC GAGING — *Radio Corp of America, Industrial and Automation Division, 12605 Arnold Ave, Detroit 39, Mich.* 12-page brochure contains complete description of systems and of each of the modules comprising them together with typical applications. Principal advantages of electronic gaging are

"There goes the whistle—quittin' time!"

AUTOMATIC PRODUCTION profits pay for the press



Minster Piece-Makers, single point and two point, have the precision and stability to give uninterrupted performance at the highest possible efficiency. 20 to 300 ton capacity.

Minster *Piece-Maker*® Presses

pay for themselves out of the higher profit per stamping you gain with Automatic Production.

In a Minster Piece-Maker you buy more parts per hour
+ higher production capacity per sq. ft. of space
+ rapid inventory turnover + less handling and storage
+ less waste and damage + longer die and press life

= higher profits that pay for the press

Minster offers a full range of press types and sizes for automatic production. Let us show you, in detail, how a Minster press on *your* job will pay for itself. Write or call

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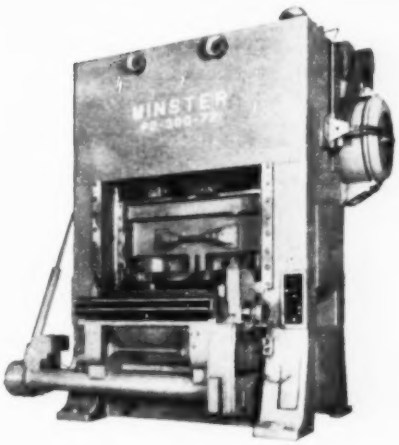

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For greater ease in aluminum drawing

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS

Oakite DRAW CLEAN "M" gives smooth drawing of aluminum —cleans off fast

Using Oakite DRAW CLEAN "M" lubricant means a lower reject rate on drawing and forming aluminum. Reason: It clings to metal so tenaciously that pressures of 40 thousand psi, encountered in drawing and punching cannot wipe it off. The thinnest film will prevent seizure that leads to build-up, galling, and scratching.

All ingredients are soluble and, at annealing temperatures, volatile. This means that while it clings where most compounds wipe off, nevertheless, it is most easy to remove when necessary. And the residue, if left on, is not harmful to metal or personnel.

Oakite DRAW CLEAN "M" lubricant offers astonishing savings. By diluting with water in ratios as high as 1 to 9 it extends die life three times the previous experience. Miscible with both water and oil, it is adaptable to any of the following:

light stamping	stretch forming	tapping
deep drawing	tube bending	spinning
cold heading	wet grinding	punching

Oakite Bulletin F-10393 tells you the whole story. For your free copy ask your Oakite man or write Oakite Products, Inc., 45B Rector Street, New York 6, N. Y.

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Technical Service Representatives in Principal Cities of U. S. and Canada

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100% repeatability, instantaneous response, high reliability, and accuracy to within 0.000050 in.

17 LUBRICATING AND ELECTRICAL DEVICES—*Trico Fuse Mfg Co, 2858 N 5th St, Milwaukee 12, Wis.* 12-page catalog 59 covers types and usage. All items are listed complete with catalog numbers, capacities, and sizes.

18 DRILL BUSHINGS AND WORK LOCATORS—*Techno-Products Corp, 507 Baily Rd, Yeadon, Penna.* 11-page catalog 103 presents information on Flar-A-Lock bushing and locator for installation in light-gage tooling material with the use of a hand flaring tool and hammer. Includes illustrations, specifications, prices, technical data.

19 TOOLS AND COMPONENTS — *Northwestern Tools, Inc, 114 Hollier Ave, Dayton 4, Ohio.* 8-page catalog 29 illustrates and describes lines of clamps, jig feet, screws, keys, bolts, nuts, studs, step blocks, punchpress sets, T-nut and stud sets, step block sets.

20 OPTICAL MEASURING SYSTEM— *Cincinnati Gilbert Machine Tool Co, 3366 Beekman St, Cincinnati 23, Ohio.* Illustrated data sheet describes features and applications of company's Tele-Vernier system for horizontal boring, milling, and drilling machines.

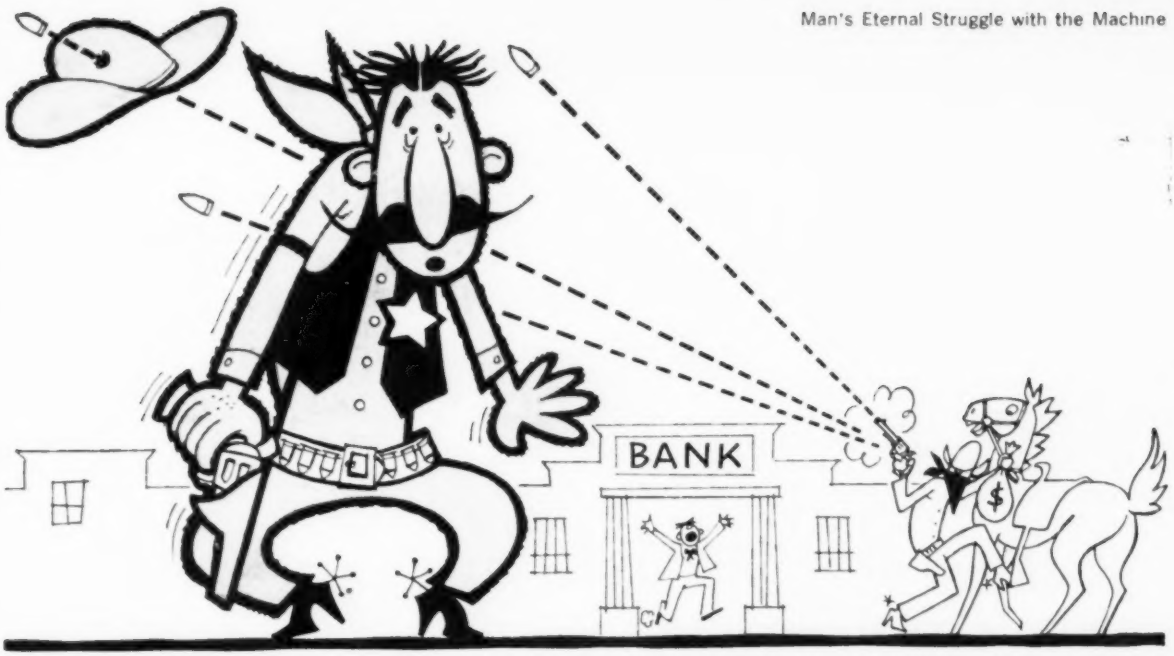
21 INSTRUMENTATION RECORDER —*Ampex Corp, Instrumentation Division, 934 Charter St, Redwood City, Calif.* 10-page brochure illustrates and describes the new FR-600 which offers a frequency response to 250 kc in direct recording and to 20 kc in FM work. Features of the machine described include air lubrication of the magnetic tape and removal of the heads from the tape except during record/reproduce or search modes. Full specifications and descriptions of accessories and optional equipment included.

22 PRECISION COUNTERS—*Chicago Dynamic Industries, Inc, Precision Products Division, 1725 Diversey Blvd, Chicago 14, Ill.* Illustrated catalog page gives technical details on new simplified design bi-directional precision degree and mil counters which have no transfer masks or shade, and no interrupted gearing to complicate operation. Series AD-1 does not count in multiples of 10, but counts hours, degrees, mils, minutes, returns to zero and repeats.

(continued on p265)

"We call this one 'Old Faithful'—it breaks down every two weeks."

Man's Eternal Struggle with the Machine



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Have you ever wished you worked in a nice, quiet little shop...?

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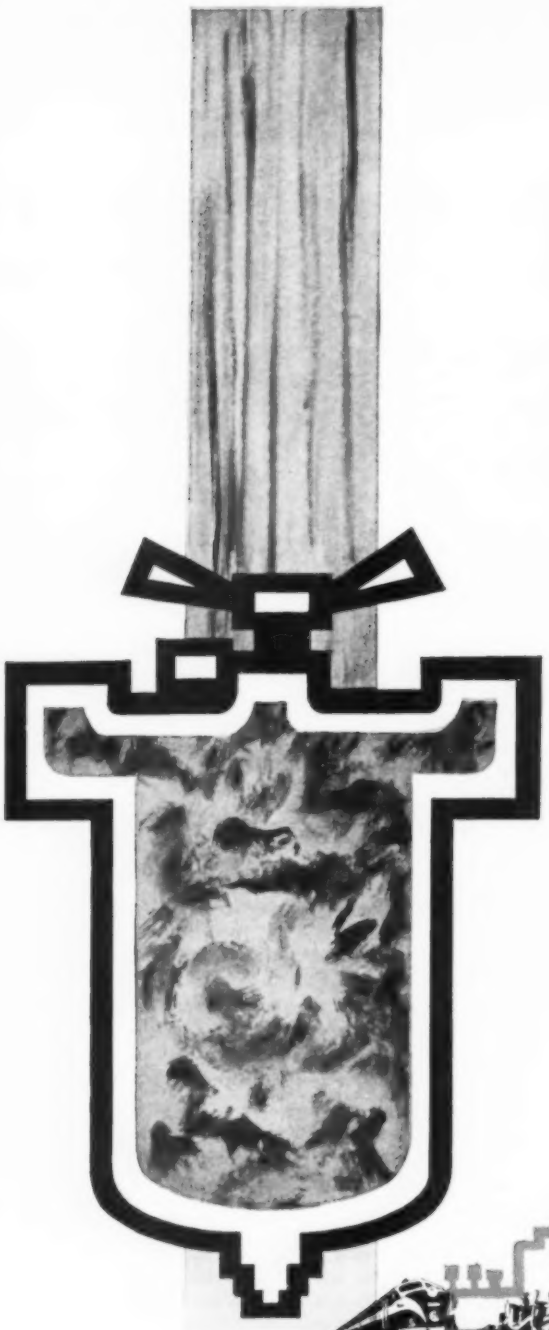

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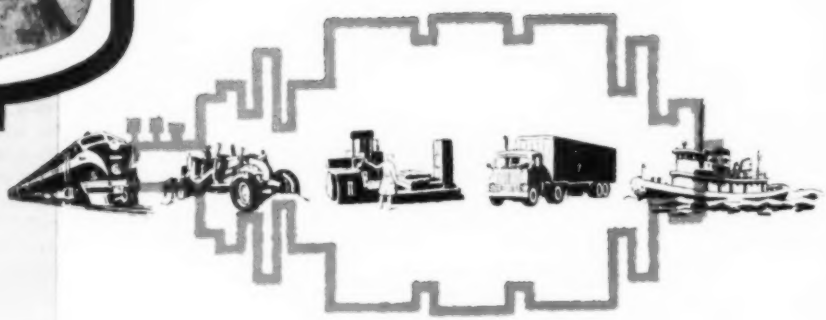

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HEAT TREATING AND WELDING

23 AIRCOMATIC WELDING WIRE POCKET GUIDE — *Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* 84-page revised edition includes latest information on Airco's complete line of gas-shielded metal-arc welding wires including data on improved A676 Steel wire and new A666 Steel and A556 aluminum. Contains technical information such as chemical composition, mechanical properties, and operating procedures, as well as wire diameters and packaging data.

24 HEAT PROCESSING OVENS — *Hevi-Duty Electric Co, Milwaukee 1, Wis.* 6-page bulletin 159 contains illustrated descriptions of complete line including both batch type and semi-automatic continuous units built in four general temperature ranges: 650, 800, 1200, and 1500 F max.

25 SEAM WELDERS — *Federal Machine & Welder Co, Warren, Ohio.* Illustrated bulletin S-59 gives complete description and specifications of three available stock sizes ranging in capacity from 50 to 400 kva.

26 WELDING T-1 STEEL—*US Steel Corp, Room 250, 526 William Penn Pl, Pittsburgh 30, Penna.* Detailed booklet on how to weld US Steel's T-1 includes a heat input calculator; this circular slide rule determines correct heat amounts as related to amps, volts, and speed of welding arc.

PARTS AND MATERIALS

● ALUMINUM FORGINGS — *Kaiser Aluminum & Chemical Sales, Inc, 1924 Broadway, Oakland 12, Calif.* 336-page book describes in detail the various types of forging processes and shows resultant forged aluminum products. Specific data on aluminum alloy characteristics as well as many details for practical forging procedures are included. Sections cover advantages; characteristics; applications; selecting the alloy; types of forgings; equipment; die sinking; quality control; heat treatment; aging; tolerances. Request direct on company letterhead.

● MECHANICAL RUBBER PRODUCTS—*Lavelle Rubber Co, 424 N Wood St, Chicago 22, Ill.* 68-page handbook M-60 covers characteristics and sug-

"I'd like to give you what you're worth, Charlie, but we have a minimum wage law in this state."

SHEPARD NILES

Monorail Hoist

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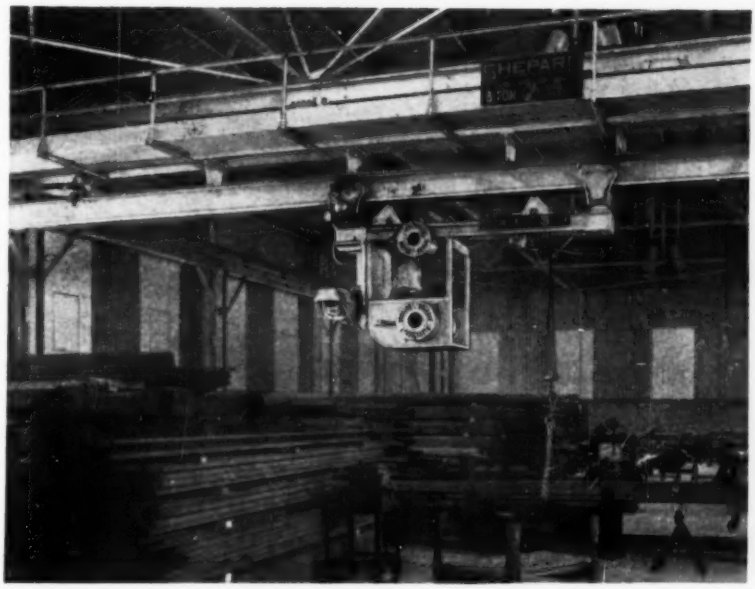

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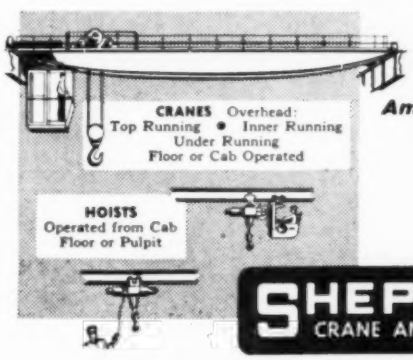

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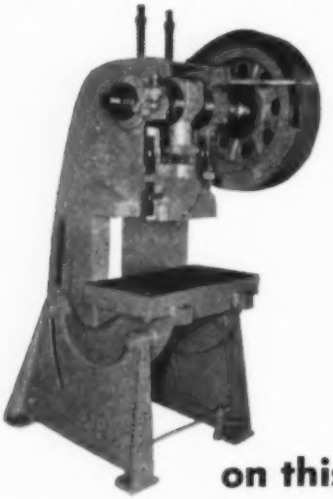

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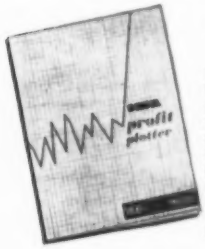

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gested uses of various rubber-like polymers; illustrates and describes molded, extruded, lathe cut, and punched rubber products. Contains base polymer charts giving resistances of vulcanates and recommendations for use under specific conditions. Request direct on company letterhead.

27 IN-LINE HELICAL GEAR SPEED REDUCERS—*Link-Belt Co, Prudential Plaza, Chicago 1, Ill.* 20-page book 2751 consolidates all of the company's expanded line in a single catalog. Provides complete selection data on 20 reducer sizes in double, triple, and quadruple reductions. Includes tables of load classes and service factors; horsepower and torque ratings; dimensions.

28 SYSTEM ENGINEERED COMPONENTS—*Acme Industries, Inc, 600 N Mechanic St, Jackson, Mich.* 8-page bulletin 300B gives capacities, dimensions, heat transfer data, and other engineering information on shell and tube condensers, shell and coil condensers, small capacity dry-ex water chillers, heat exchangers, oil separators, liquid receivers, and vertical shell and coil condensers.

29 INSERTS—*Hi-Shear Rivet Tool Co, 2600 W 247th St, Torrance, Calif.* 4-page brochure describes the new S110 insert. Describes how hole preparation cost is reduced, simplicity of installation, variety of tooling and removal. Test results for push-out, torque-out, and tensile strength are graphed.

30 COLD HEADING WIRE — *Scovill Manufacturing Co, Mills Division, 99 Mill St, Waterbury 20, Conn.* 4-page bulletin contains information on extruded cold heading wire (cartridge brass, 70%). Describes applications and advantages, lists available stock tempers, gives characteristics of the material, and specifications.

31 SMALL BASIC SWITCHES—*Micro Switch, Freeport, Ill.* 20-page catalog 63 covers four groups: type V3 postage-stamp-sized switches; type TB 2-circuit switches, type 1SX1 sub-subminiature switches; and type SM subminiature switches. Typical auxiliary actuators and assemblies are shown with each of the four types. Contains details on 100 switches, actuators, and assemblies.

32 TRANSPARENT SILICONE POTTING COMPOUND—*Dow Corning Corp, Midland, Mich.* 4-page illustrated brochure describes Dielectric Gel that permits visual and instrument checking of

(continued on p269)

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PIONEER'S THRUST CHAMBER TAKES BLASTING HEAT—LASTS 50% LONGER!

Aerojet General Corporation added 50% more operating life to Pioneer's second-stage thrust chamber with Linde's Flame-Plating process. Now, the lightweight aluminum tube, Flame-Plated with a thin (.003 in.) coat of tungsten carbide, has thermal and erosion resistance that stands up to the metal-killing temperatures of the combustion flame.

With this special Linde process, you can have metals coated with tungsten carbide, aluminum oxide, and other materials to provide outstanding resistance to wear, abrasion, and fretting corrosion, even at extreme temperatures. If necessary, these coatings can be ground and lapped to one micro-inch rms or better. They consistently outlast hard chrome plating, tool steels, and in some cases, solid tungsten carbide.

When coatings of refractory metals such as pure tungsten, tantalum, molybdenum, and other ultra-high-melting-point metals are desired, Linde Company offers its new "Plasmarc" Torch service. To find out how Flame-Plating or the "Plasmarc" Torch service can solve your critical temperature and wear problems, write Dept. AM-102 Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y.

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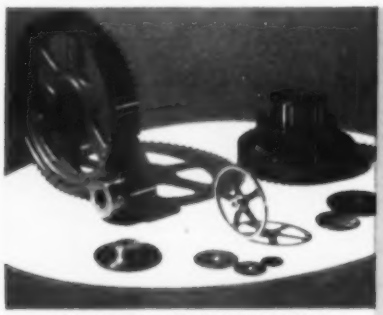
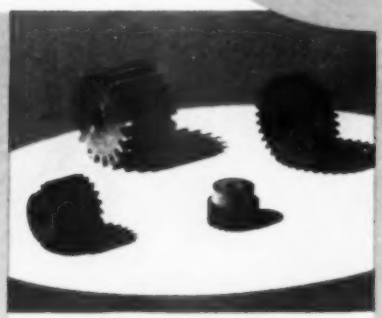


SPUR GEARS — STEEL, IRON, BRASS
14½° and 20° P.A. .208" to 40" P.D.



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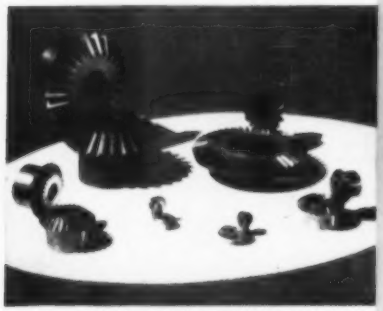

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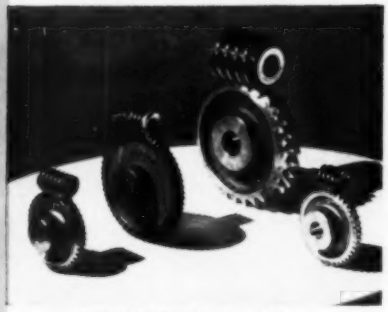

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Soft Steel and hardened and ground steel

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individual parts within a potted assembly. Material cures in place to form a resilient, protective mass that retains its outstanding dielectric properties and moisture resistance over the temperature span of -60 up to 200 C. Tables of properties included.

33 MOTOR-TACH GENERATORS — *John Oster Mfg Co, Avionic Division, 1 Main St, Racine, Wis.* 16-page catalog 6000 lists and describes all basic models of complete line, sizes 8 to 18, for scientific, military, and industrial applications. General descriptive data and definitions, performance curves, dimensional drawings, and physical, electrical, and mechanical characteristics are included.

34 GEARMOTORS — *Allis-Chalmers Manufacturing Co, Milwaukee 1, Wis.* 8-page bulletin 51B9172 covers design and construction features of units available from ¼ to 100 hp. Describes integral and all-motor types including right angles as well as special designs.

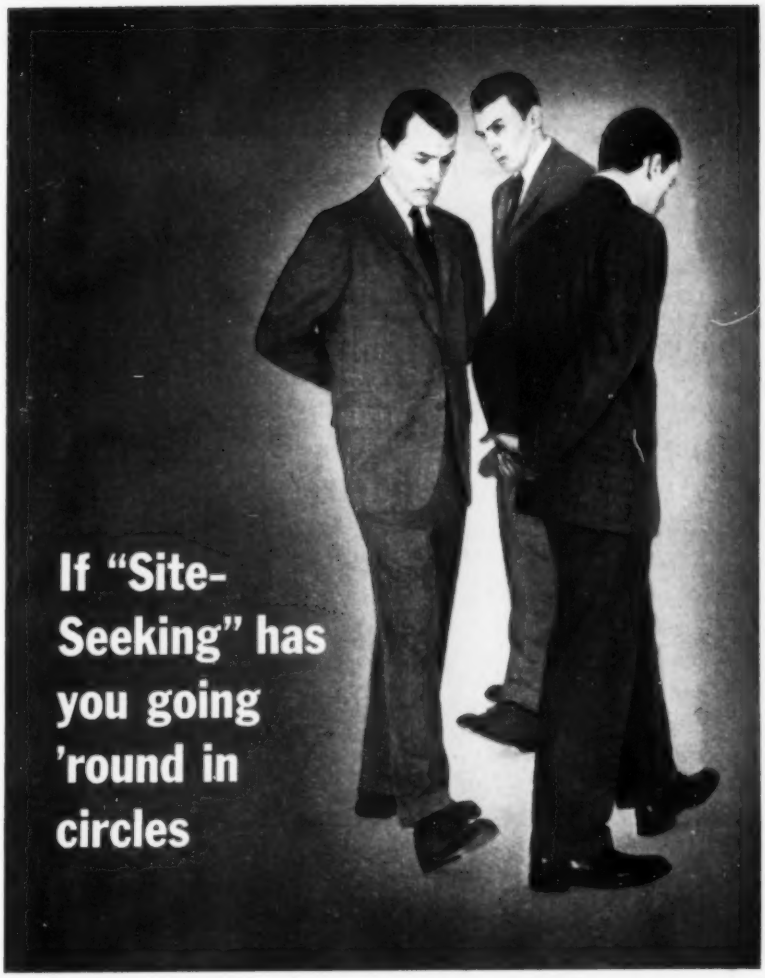
35 SPLINE DRIVE ARMATURE ASSEMBLY—*Warner Electric Brake & Clutch Co, P-68, Beloit, Wis.* 4-page brochure, form P-68, describes new armature drive for heavy-duty applications. Includes sections on operation, dimensions, replacement parts, and installation.

36 MOLDING COMPOUNDS AND RESINS — *Durez Plastics Division, Hooker Chemical Corp, North Tonawanda, NY.* 8-page bulletin 400 contains general data on properties and uses of thermosetting phenolic and diallyl phthalate molding compounds, fire-retardant Hetron polyester resins for reinforced plastics, and phenolic resins for bonding and coating. Includes product application photos and chart showing typical properties of Hetron resins.

37 SELF-LUBRICATING PACKINGS —*Greene, Tweed & Co, North Wales Penna.* 12-page catalog SLP-659 decribes Palmetto self-lubricating packings, their advantages, and applications on pump rods, shafts, and valve stems. Each of 29 types is illustrated and discussed. Calculation table on weights and lengths included as well as details on recommended service, uses, temperature limits, sizes, standard packagings and prices.

38 EQUIPMENT CONTROL CONNECTORS — *Joy Manufacturing Co, Electrical Products Division, 1201 Macklind Ave, St Louis, 10, Mo.* 12-page bulletin 372 provides information on neoprene units designed for applications up to 600 v;

"Well, you asked for 'top pay,' didn't you?"



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available in three basic styles—oval, round, or dual round—2 to 12 poles. Includes description of construction features, product photos, dimensions, specifications, and examples of typical applications.

39 "STEEL CASTINGS — CARBON AND LOW ALLOY"—*Strong Steel Foundry Co, 53 Norris St, Buffalo 7, NY.* Brochure lists complete chemical and physical data and properties on various alloys that are most commonly used for steel castings. Includes photos of wide variety of castings that are produced in these alloys.

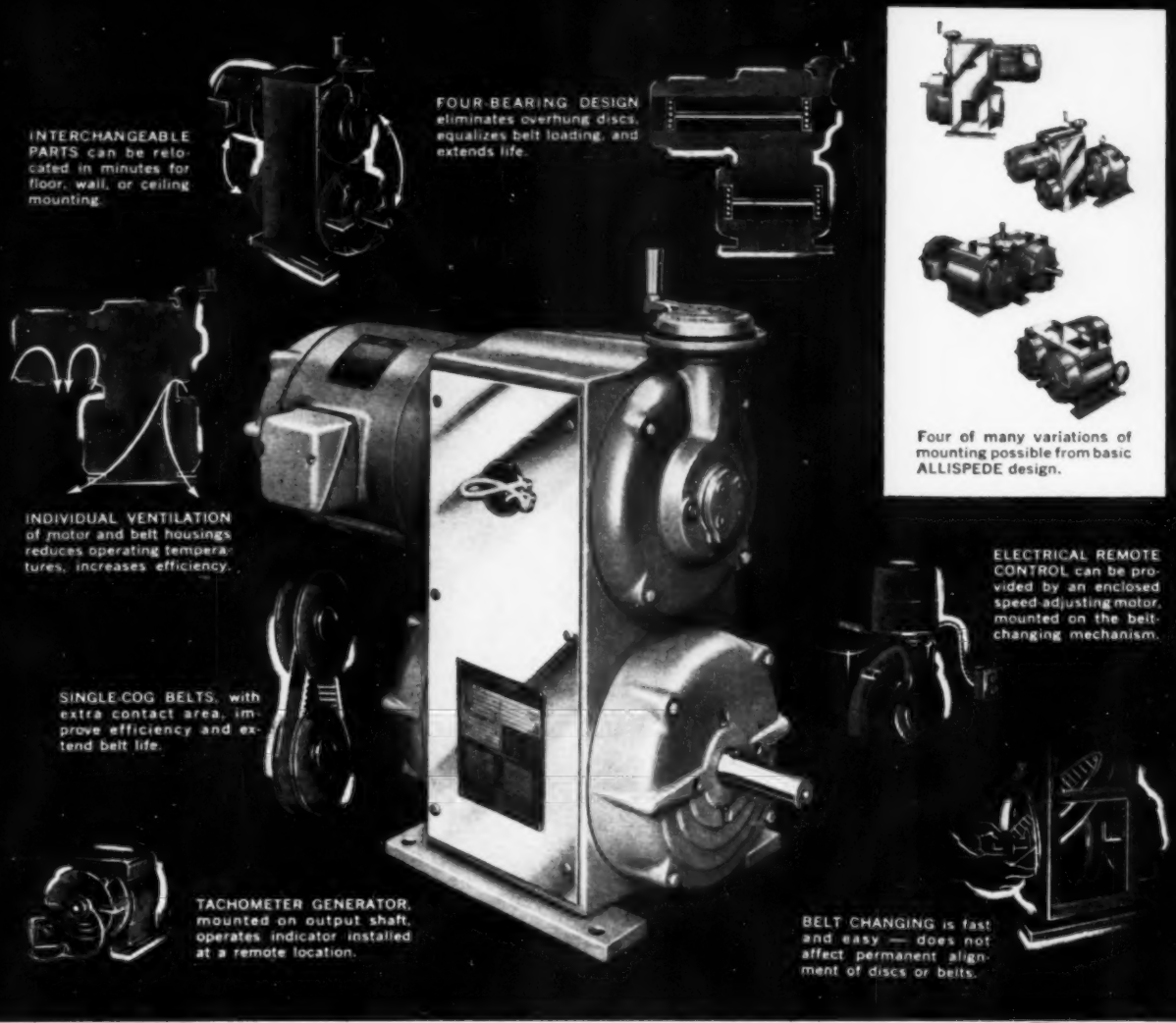
40 INDUSTRIAL HOSE AND FITTINGS — *Weatherhead Co, Fort Wayne Division, 128 W Washington Blvd, Fort Wayne, Ind.* 128-page illustrated catalog C-300 contains specifications, technical data, sizes, descriptions, applications, and installation instruction on hose and hose assemblies, brass and steel tube fittings, hose and tube working tools, stock cabinets, hose racks, and other specialty products for hydraulic, air, and fluid systems.

41 NYLON SHAPES—*Polymer Corp of Pennsylvania, 2140 Fairmount Ave, Reading, Penna.* 8-page bulletin BR-2M tells how to engineer Polypenco shapes for various applications. Presents 22-case histories to demonstrate how nylon's properties can be converted into cost-saving applications. Uses illustrated include bearings, gears, rollers, wheels, and fixtures.

42 TOOL STEEL—*Uddeholm Co of America, 165 E 44th St, New York, 17, NY.* 12-page illustrated booklet gives information on Tri-Tung, a high-carbon, high-chrome, air and oil-hardening tool steel which is capable of great hardness, exceptionally good wear resistance, and manifests minimum distortion with air-hardening. It is recommended for use wherever extreme accuracy of size and contour must be retained through long production runs.

43 MECHANICAL DRIVE—*Louis Allis Co, 427 E Stewart St, Milwaukee 1, Wis.* 6-page bulletin 3600 describes the Allispede mechanical adjustable speed drive that operates on ac power, offers speed ranges up to 8:1, and is available in ratings from 1 to 30 hp.

"You needn't have bothered calling to tell me you're ill and won't be in today, Conklin. This is Sunday."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New Louis Allis drive offers accurate control—maximum belt life—long-run economy—low-cost versatility—ease of installation

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As for versatility — there's an Allispede to meet whatever mechanical drive requirement you have. Sizes up to 30 hp, output speeds from 1 to 10,000 rpm, and speed ranges up to 8:1. Motors can be open, drip-proof, enclosed, or explosion-proof—with ventilated or enclosed belt housings — for foot, P-base, C- or D-flange mounting on your machine.

Allispede is available with parallel shaft, or right-angle, integral speed reducers; special shaft extensions; integral magnetic brakes; electrical or mechanical remote control, and other modifications.

Interested? Contact your nearby Louis Allis District Office or write to The Louis Allis Co., 4 East Stewart Street, Milwaukee 1, Wisconsin, for a copy of Bulletin 3600.

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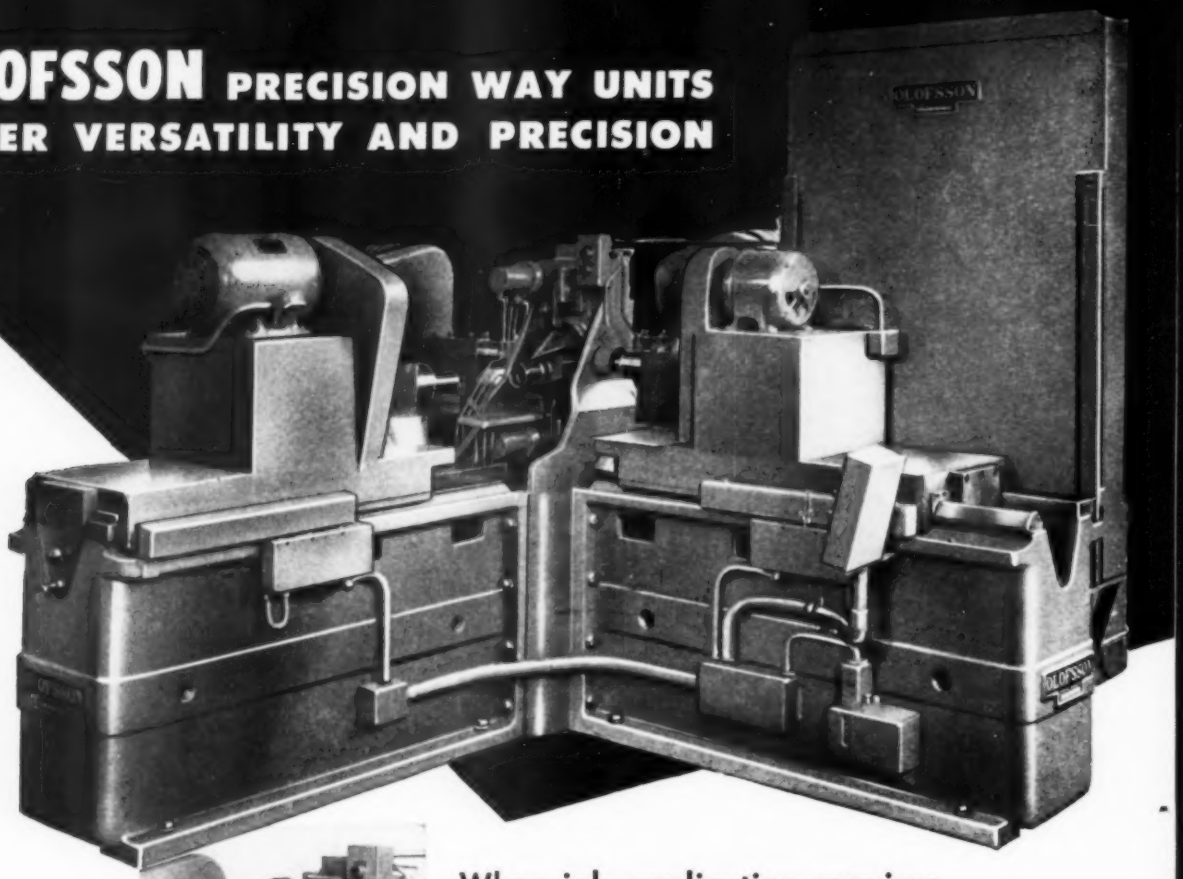
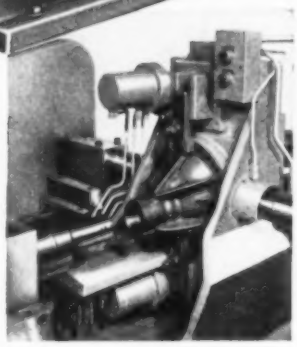


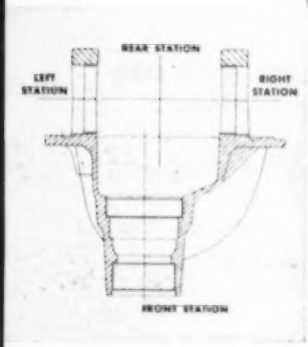


Differential carrier, hydraulically cam-clamped in position for simultaneous precision boring.

Cross-section of differential carrier illustrating various operations performed.

When job application requires versatility consider the use of Olofsson Way Type Precision Boring Units.

These Units can be arranged to meet your particular production requirements. Use one way unit . . . two units at either 90° or 180°, 3, 4 unit, or multilpe units. Units can be combined with a center fixture section to suit production requirements.



The 4-Way Machine illustrated above makes 4 precision bores simultaneously. Diameters are held to .0005" with the required 90° angles. When required, progressive operations can be performed on the part. Units are electrically interlocked, operate from a single push-button station.

For a demonstration of how Olofsson Way Units can suit your particular production requirements, call on your local Olofsson representative.

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Phone IU 45381

MACHINERY DIVISION

Sheffield Corp, Dayton, Ohio, has appointed **Louis Polk Jr** assistant vice president and manager of its gaging and automation systems. He was previously manager of the Measuray section which produces a complete line of industrial X-ray gages

Union Twist Drill Co, Athol, Mass, has elected **George M Brydon** a vice president of the company. He will continue as general manager of the Butterfield Division, Derby Line, Vt

Hanson-Whitney Co, Hartford, Conn, manufacturer of taps, gages, and cutting tools, has elected **Brenniss G Tyrrell** executive vice president. He was formerly executive vice president of Whitney Chain Co

NAMES IN THE NEWS...

AC Spark Plug, Division of General Motors, has promoted **Clifford L Johnson** to manufacturing manager of Hyatt Bearings Division, Harrison, NJ. **James L Elliot** succeeds Mr Johnson as director of production engineering at AC in Flint. He was formerly superintendent of production engineering.

Minneapolis-Honeywell Regulator Co has appointed **Frank P Kelly** manager of manufacturing operations for the Philadelphia - based Brown Instruments Division. Formerly general superintendent, he succeeds **Frank M Rea** who has been assigned to Honeywell's industrial products group as a consultant in engineering, tooling, and subcontracting.

Allis-Chalmers, Milwaukee, has appointed **Russel A Hedden** work manager of manufacturing, Industries Group, at A-C's West Allis (Wis) Works. Formerly works manager of the York (Penna) Works, he succeeds **E W Bonnes** who has been named consultant to the director of manufacturing, Industries Group.

General Motors Corp has named **Richard L Terrell** a vice president of the company and general manager of the Electro-Motive Division. He succeeds **Nelson C Dezendorf** who has been appointed vice president in charge of GM's Dayton, Household Appliance, and Electro - Motive group. Mr Terrell was previously administrative assistant to Mr Dezendorf. **William H Harvey** has been named director of production, Electro-Motive, and **B B Brownell** director of engineering and research.

Sylvania Electric Products, New York, has elected **Henry Lehne** a senior vice president. He will have over-all responsibility for Sylvania Electronic Systems, a major division of the company. Mr Lehne, who has been vice president and general manager of the division, will continue to make his headquarters in Waltham, Mass.

Baker Industrial Trucks, Division of Otis Elevator Co, Cleveland, has appointed **Thomas C McKnight** product manager, electric trucks. He replaces **Edward P Patrick** who has been named sales application specialist.

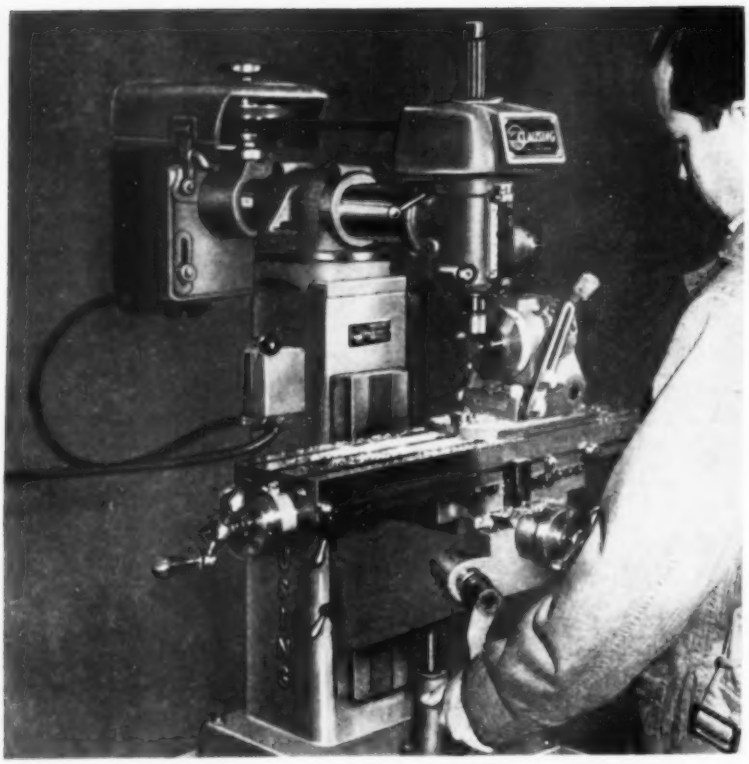
SKF Industries, Inc, Philadelphia, has named **Bruce M Smith** chief industrial engineer to succeed **Stuart J Northrop,** now mechanical superintendent. Prior to joining the company, Mr Smith was associated with Standard Products Co, Cleveland, as director of industrial engineering.

Pressed Metal Institute has elected **F F Rimmler,** Volkert Stampings, Inc, Queens Village, NY, president for the coming year. New vice presidents are **M A Sherwood,** Grand Haven Stamped Products Co, Grand Haven, Mich; and **W J Primrose Jr,** Dickey-Grabler Co, Cleveland.

Marshall & Huschart Machinery Co, Chicago, has appointed **Myron A Lindgren** to the senior sales staff.

Lindberg Engineering Co, Chicago, has appointed **Leon C Koenig,** vice president, manufacturing. Mr Koenig, a company founder, has been assistant secretary and plant manager

Saco-Lowell Shops, Boston, has appointed **Edward C Lanno** director of manufacturing services.



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The high precision spindle and drive have 7 ball bearings . . . hardened spindle. Ground and hard chrome plated quill has full length bearing in head.

The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to machine at all angles with one set-up.

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VERIFIED ACCURACY— Before it leaves the factory each CLAUSING Mill must pass rigid tolerance tests such as:

1. Top of table perpendicular to column ways within .0005" in 6" travel.
2. T-slots square with cross slide dovetails within .0005".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

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NAMES IN THE NEWS...

Leece-Neville Co, Cleveland manufacturer of electrical equipment, has named **James A Marlon** executive vice president. He was formerly vice president of the Crane Co, Chicago.

E W Bliss Co, Canton, Ohio, has appointed **E W Shuster** coordinator of foreign business. He will headquarter in the company's general offices. **H A Lampmann** has been appointed manager of European sales engineering.

Union Die Casting Co, Whittier, Calif, has appointed **John E Grimshaw** plant superintendent. He was formerly associated with Philips Manufacturing Co as plant manager and chief engineer.

Titeflex, Inc, Springfield, Mass, has named **Daniel W Ruple** vice president and general manager of the Pacific Division. He was formerly assistant to the president of the company.

Armstrong Bros Tool Co, Chicago, has appointed **John F Gaudian** assistant sales manager. He will continue to supervise Chicago district sales in addition to his new duties.

Dow Chemical Co, Midland, Mich, has elected **Donald K Ballman** and **C B Branch** vice presidents of the company. Mr Ballman is director of sales and Mr Branch manager of overseas operations.

Instrument Society of America has elected **John Johnston Jr,** chief of instrument consultants in the Du Pont Co's engineering service division, president of the Society. **Dr Ralph H Tripp,** assistant director of the flight test division of the Grumman Aircraft Co, has been elected president-elect-secretary of ISA.

Siegler Corp, Los Angeles, has elected **John J Burke** a vice president of the company. He will coordinate the military activities of the Hallamore, Olympic, Hufford, and Bogen-Presto divisions of the organization which are engaged in missile and space age aspects of the defense program. He was previously executive vice president of the Hallamore Electronics Division.

Massey- Ferguson Ltd, Toronto has named **T J Emmert** vice president, North American operations, with responsibility for the company's business in the US and Canada. Mr Emmert, formerly executive vice president of Ford Motor Co of Canada, joined Massey-Ferguson in June as a vice president.

Electric Autolite, Toledo, has named **Ralph E Wittman** quality manager for the Toledo Division. Mr Wittman has been associated with the company for 26 years in production and quality maintenance of products.

Clippard Instrument Laboratory, Cincinnati, has appointed **Ralph W Smith** executive vice president. He has been associated for the past six years with Coil Craft, Inc.

Cutler-Hammer Inc, Milwaukee, has appointed **E C Bolton** midwestern regional sales manager with headquarters in Chicago. He formerly managed the firm's Cincinnati office.

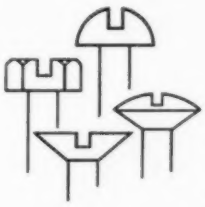
Cameron Iron Works, Inc, Houston, Texas, has promoted **J F Allen** to manager of manufacturing of the Pressure Control Equipment Division. He has been serving as manager of Cameron's guided missile plant. **Harry H Walsh,** formerly manufacturing engineer for the missile activity, succeeds Mr Allen.

Carborundum Co, Niagara Falls, has promoted **Robert C Straka Jr** manager of its Ceramic Fiber Project. He was previously manager of specialty product engineering for the Refractories Division.

Rockwell Manufacturing Co, Pittsburgh has named **Brig Gen Joseph M Colby (Ret)** vice president, engineering. He was previously Deputy Commanding General, US Army Ordnance Missile Command, at Redstone Arsenal, Ala.

Fairbanks, Morse & Co, Chicago, has named **George H Herrick** vice president and general manager of the Electrical Division. He has been serving as coordinator of electrical operations.

Budd Co, Philadelphia, has named **William H Knowles** sales manager, Defense Division. He joined the organization in 1953 and was responsible for organizing the company's Nuclear Energy Division.



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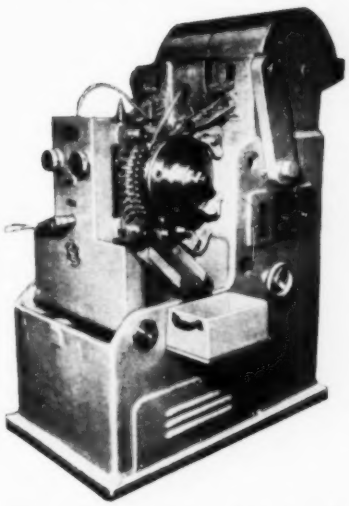

Model asm 6 with 2x10 slotting tools shown.

These famous German built machines feature:

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- GRINDING FIXTURE—sharpens all 10 cutters at once on a standard surface grinder
- BURR FREE SLOTTING—of any type screw head
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NAMES IN THE NEWS...

American Steel Foundries, Chicago, has appointed **Chester E Grigsby** head of the Transportation Equipment Division. Mr Grigsby, a company vice president, has been serving as general manager of the division.

A O Smith Corp's Welding Products Division has made **D H Buerkel** regional sales manager of all industrial east coast welding sales activities. He will continue to headquarter in Philadelphia where he has been serving as district manager.

Bilgram Gear & Machine Works, Philadelphia, has appointed **Adrian Marmor** president and general manager. He was formerly a director and member of the executive staff of the Hale Fire Pump Co.

Pacific Coast Engineering Co, Alameda, Calif, has appointed **Alex McClure** general sales manager. He was formerly sales manager for American Glass Fibers, Inc.

Farrel-Birmingham Co, Ansonia, Conn, has appointed Harlan J Hauser manager of field sales to succeed **D Wheeler Clark.** He was previously sales manager of the Watson-Stillman Press Division at the Rochester plant.

Michigan Abrasive Co, Detroit, has appointed **Richard P Villwock** research engineer. He was formerly research director of Midwest Abrasive Co, Owosso, Mich.

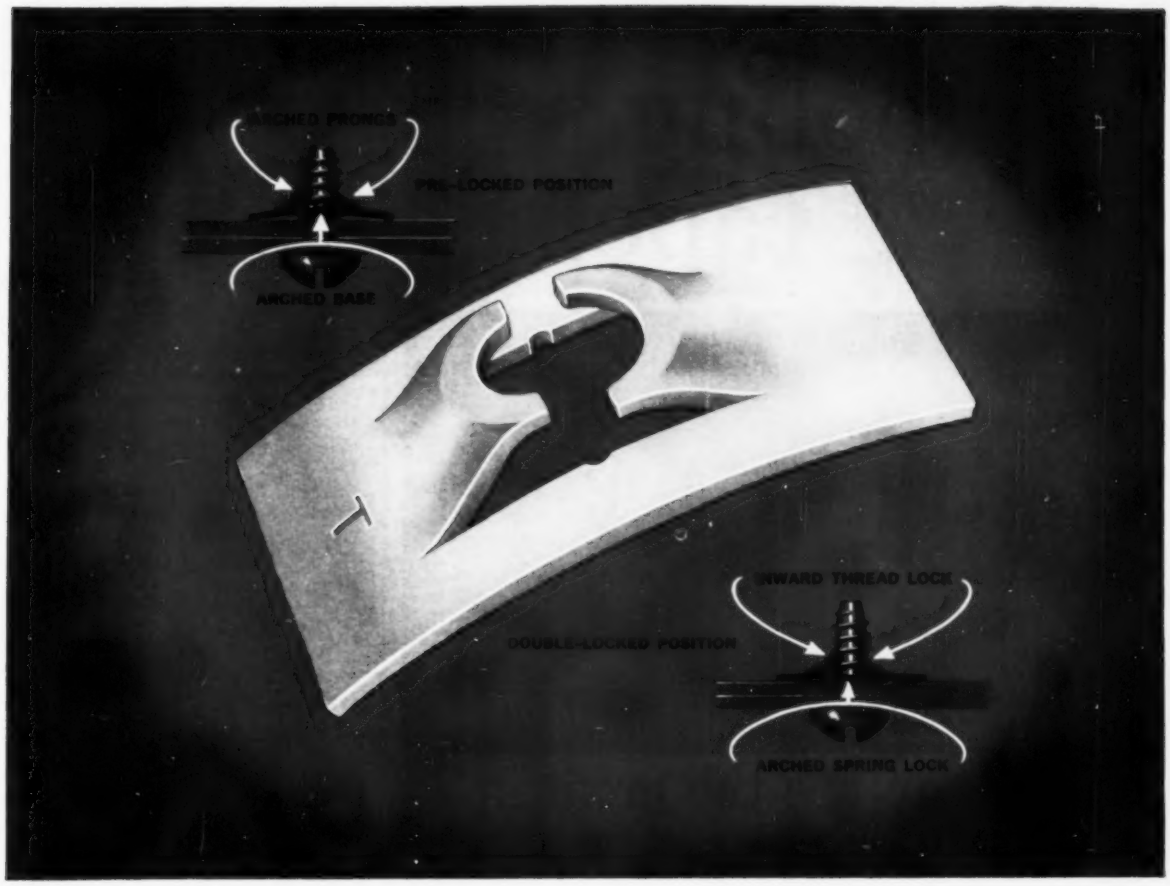
Weldon Tool Co, Cleveland, has named **S E Smith Jr** assistant sales manager. He was previously associated with the Machinist Tool & Supply Co, Los Angeles.

Packard Bell Electronics Corp, Los Angeles, has named **William O Laande,** former engineering representative and Boeing Aircraft instrumentation specialist, Packard liaison engineer.

Aluminum Co of American has named **Kirk Usher** manager of tubular product sales.

OBITUARY

Stanley W Lovejoy, 59, manager of engineering research, Cutting Tool Division, Pratt & Whitney Co, West Hartford, Conn, died Sept. 25.



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Drive the screw and this spring-steel fastener locks tight, never to shake loose; yet easy to remove and reuse whenever you desire. SPEED NUTS won't freeze on screw threads!

Tinnerman Flat-Type SPEED NUTS are made in a full range of sizes, tensile strengths and corrosion-resistant finishes. Design variations also provide many multiple-function special types.

Lower cost per thousand plus lower cost of assembly give you maximum cost-reduction benefits . . . with maximum fastening assurance.

For more information, refer to your Sweet's Product Design File, section 7-Ti. Your Tinnerman representative has samples and prices. He's listed under "Fasteners" in the Yellow Pages. Or write to:

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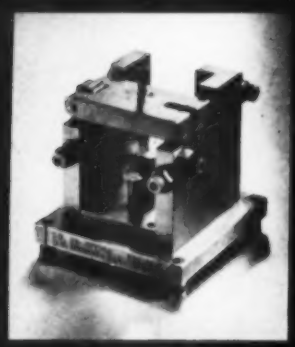
Tooling with tape...



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This drill jig: $4.20

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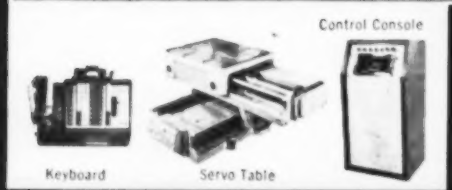

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NEW BOOKS...

METAL STAMPING — *Published by American Society of Tool Engineers, 10700 Puritan, Detroit 38, Mich. Price (to ASTE members) 75¢; non-members, $1.50.*

Technical information of interest to tool engineers who work in metal stamping has been issued by the Metal Stamping Project Steering Committee of the ASTE's Research Fund.

The report is based on a translation made available by Armco Steel Corp. Two German engineers, Otto and Werner Kienzle, prepared the material for a recent issue of *Stahl und Eisen*. The article, "Tool Wear in the Cutting of Thin-Gauge Sheet Steels," originally appeared as a report to the materials committee of the Association of German Iron and Steel Engineers.

Containing considerable new data, it tells of research in three groups of sheet materials and discusses the authors' reasons why rough punched faces are preferred.

•

EPOXY RESINS; MARKET SURVEY AND USERS' REFERENCE—*Prepared by the Graduate School of Business Administration, Harvard University. Published by Materials Research, Box 363, Cambridge 39, Mass. 200 pages. Size 8 x 11 in. Cardboard cover. Price $18.50.*

This book resulted from student research in manufacturing, and is about as complete a survey of physical, technical, and economic aspects of the material as possible in this amount of space. It is not a "how-to-do-it" book, but an analysis of the properties, applications, and advantages of epoxy. Not to place undue emphasis on the book, but to illustrate the importance of epoxy—just one of a number of new plastic materials—to Metalworking, here are some points brought out in the survey:

Of 24 industries covered in relation to epoxy resins, at least a dozen or more are important to metalworking manufacturing; for example: aircraft, automotive, appliances, military, shipbuilding, and railroads.

The aircraft industry is the largest user of non-coating epoxy, applying the resin to metal- and glass-reinforced tooling. Forming tools of the material have short lives, but some inspection and holding fixtures are comparable to metal structures

for lasting qualities. However, plastics are well suited to the short runs in many aircraft plants. One example of cost savings shows that an epoxy drop-hammer die saved 70% over a steel die—all in labor and overhead charges.

In addition, light weight saves in handling and storage costs, and corrosion resistance allows long storage —even outside.

Comparative tables for cast and laminated epoxy vs polyesters and phenolics show the epoxy wins for strength, water and heat absorption, and machining ease.

Expenditures for epoxy in aircraft manufacturing have risen sharply—one company went from $5000 in 1953 to $100,000 in 1958. Draw dies of many kinds, trimming dies, rubber-pad dies, stretch dies, and fixtures and gages are made. The material also functions as a bond between metal parts.

In the automotive industry, the use of epoxy dates back some 20 years—on an experimental basis. Forming dies are for prototype work and for short runs; such as on some truck panels and limited-production models. Epoxy can also be applied to tooling for cutting tools; a simple drill jig in epoxy cost a third the price of a steel jig.

Epoxy coatings have gained a place in appliances, where primer coats are flowed onto the steel bodies to replace porcelain. One analysis shows cost savings of a third. Die work is also successful; in one case die inserts were obtainable in much

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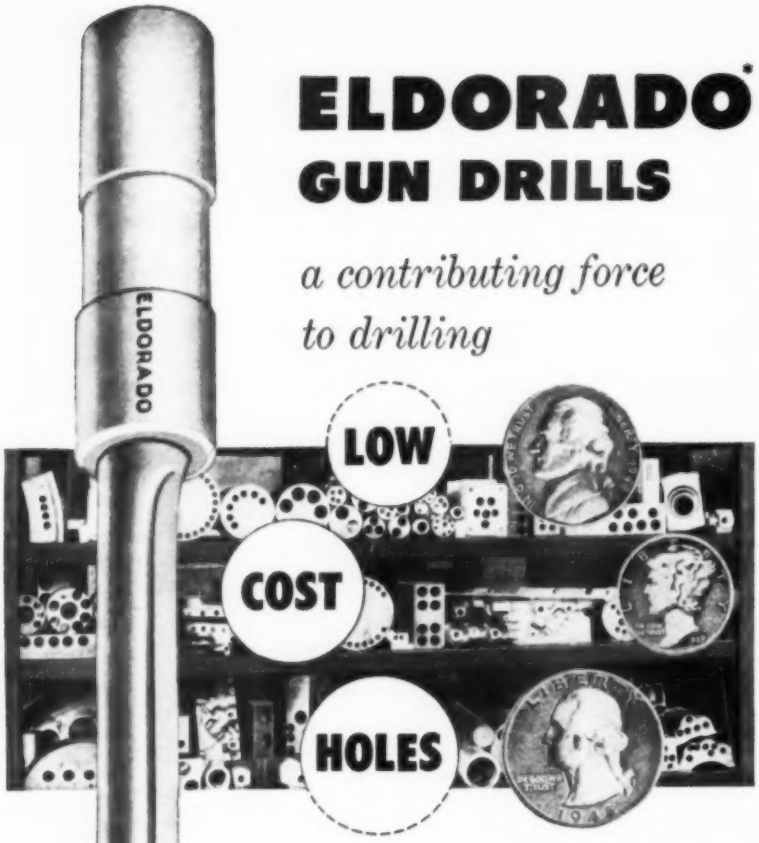

Precision drilling holes at a minimum cost, without loss of accuracy in hole alignment and surface finish, requires gun drills of absolute uniformity.

ELDORADO'S 'job-proven' gun drills have this designed-in quality to pay off in continuous low-cost hole drilling. Designed to gun drill holes to close tolerances... to micro-finish, in *one single operation;* economically solving 'hole' problems in most materials.

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OA Lengths	4" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Drivers	Std. or to fit your need	.750" dia. x 2 3/4" long	1" dia. x 2 3/4" long
Tips	Carbide	Carbide	Carbide
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less time than steel die inserts, and they performed for 65,000 stampings.

Military applications include many kinds of housings, and even exterior parts of missiles. The shipbuilding industry applies epoxy coatings to boat and ship hulls with results that are worth the extra costs by saving on corrosion and barnacle waste.

This book can undoubtedly show new areas for investigation to people in Metalworking who normally consider only metals for every job. Epoxy is not a normal, tradition-bound material, but is being fitted, like many other plastics, into production and tooling in many new ways each day. The book might easily be worth the relatively high cost for any supervisor or executive in Metalworking.

•

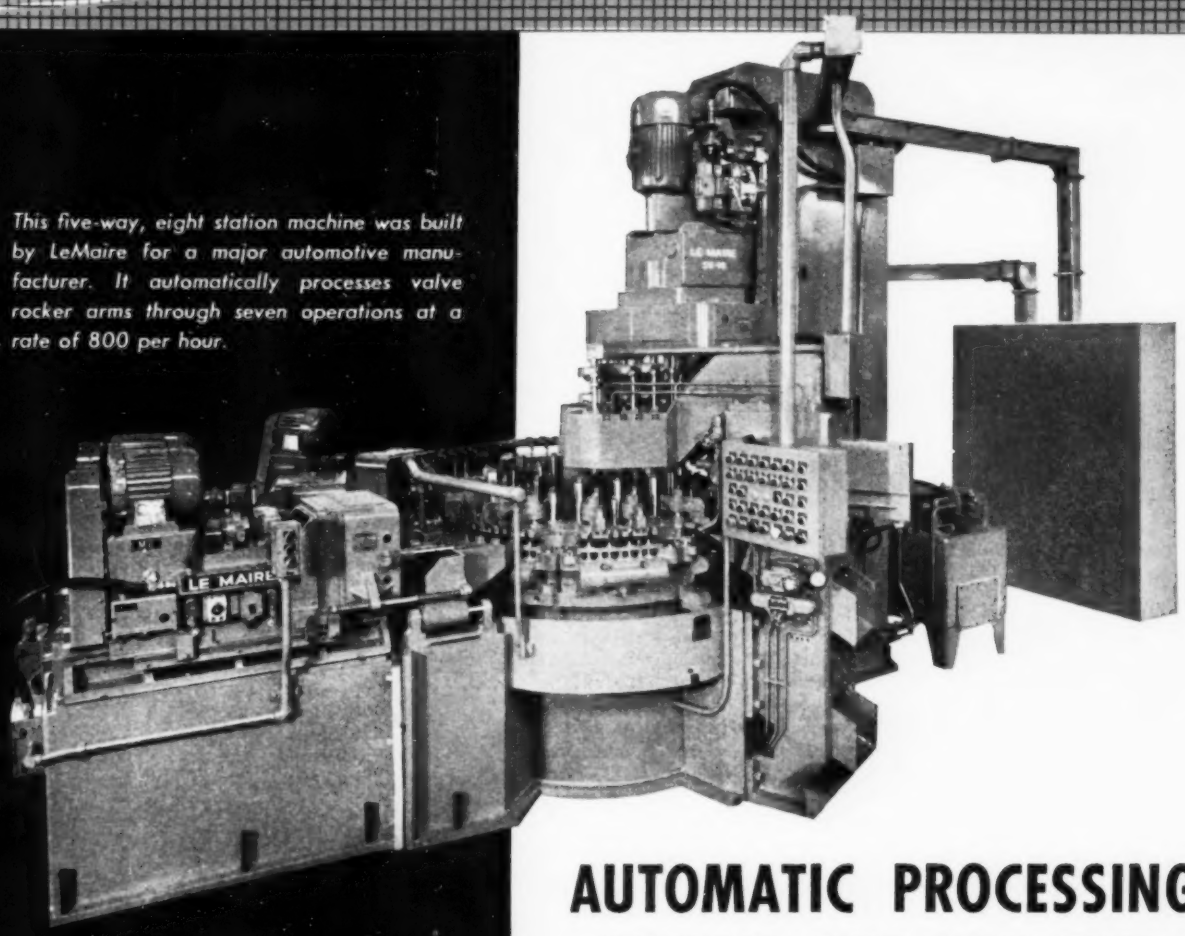
CORROSION PREVENTION—*Published by OTS, U S Dep't of Commerce, Washington 5, DC. 431 pages. Price $6.00. Order as PB 151756.*

Prepared by the Navy's bureau of yards and docks for internal use, this new publication is now available to industry. Data are presented on atmospheric, submerged, and subsurface corrosion, and on areas alternately wet and dry. What the Navy has found to be the most practicable methods and materials for controlling corrosion are described in detail.

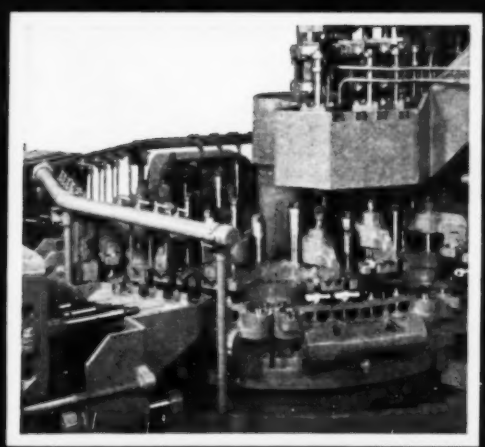
Among corrosion processes discussed are those caused by use of dissimilar metals, direct chemical attack, stray currents, microbiological and atmospheric attack, and

"It's always stubbing its toe."

PRODUCING with LE MAIRE



This five-way, eight station machine was built by LeMaire for a major automotive manufacturer. It automatically processes valve rocker arms through seven operations at a rate of 800 per hour.



Here's a close-up of the automatic hydraulic indexing table. Work-holding fixtures have pilot bushings that register with sliding bushing plate for positive alignment.

AUTOMATIC PROCESSING

SEVEN OPERATIONS
800 PARTS PER HOUR

The variety of operations and efficiency of this machine clearly demonstrate the versatility of application inherent in LeMaire hydraulic, self-contained way-type power units. They are mounted on this machine in horizontal, vertical and angular positions to perform seven different operations. Here's the eight-station sequence of automatic operations:

(1) Manually load four valve rocker arms
(2) Drill .094" diameter hole at 30° angle
(3) Drill 25/64" diameter hole
(4) Countersink .469" diameter and spot face 7/8" diameter
(5) Tap 7/16"-20 American National Thread
(6) Chamfer .7925" hole
(7) Finish ream .7925"/.7935" hole
(8) Automatically unload and wash fixture

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CATALOG NO. 258—Listing 343 Bunting Cast Bronze Electric Motor Bearings for all makes and sizes of electric motors from 1/50 to 100 HP.

BAR CARD 40—Listing 138 sizes of Bunting Bearing Aluminum Tubular and Solid Bars and giving comprehensive data.

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Write for "**ENGINEERING HANDBOOK ON POWDER METALLURGY**"—an authentic technical 48 page book by Bunting Engineers.

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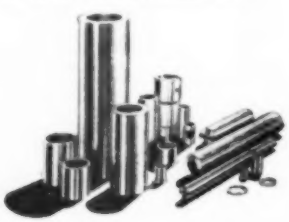

BEARINGS, BUSHINGS AND SPECIAL PARTS OF CAST BRONZE OR SINTERED METALS.
ALCOA® ALUMINUM BARS.

The Bunting Brass and Bronze Company, Toledo 1, Ohio
Branches in Principal Cities EVergreen 2-3451

marine corrosion. Control methods include use of nonmetallic materials and coatings, claddings, and coverings, use of passivators or inhibitors, underground backfills, and combinations of zinc and iron in hot water facilities.

One section presents a selection of material combinations and metals, with a discussion of polarization; another discusses cathodic protection and electrochemical processes.

•

MAGNESIUM CASTING TECHNOLOGY—*By A W Brace and F A Allen. Published by Reinhold Publishing Corp, 430 Park Ave, New York 22, NY. 174 pages, 5½ x 8½ in. Price $4.95*

This review of the basic principles of magnesium alloy casting points out the theories underlying the production operations — giving the "why" as well as the "how to" aspects of this field. The basic physical and chemical properties of magnesium and its principal alloys form a background against which the authors present both American and British foundry techniques.

Published also in London, by Chapman & Hall Ltd, the book presents chapters on basic alloy properties, melting practice, choice of sands, sand casting, permanent mold casting, pressure die casting, and the heat treatment, inspection, and surface treatment of magnesium castings.

Though much of the material is based on a paper several years old, the material has been revised and expanded to make this book a good single source of information on magnesium alloy casting. The illustrations are tied closely to the text, especially in the sections dealing with die design. A comprehensive bibliography is included.

PICKLED in a 4% brine solution!

CHOKED
in a tornado of abrasive dust!

FROZEN
for weeks at 75° C below zero!

BURIED ALIVE
in thick, sluggish mud!

nothing . . . but nothing stops Super-Seal open-type motors

Thanks to exclusive Poxeal and Silco-Flex insulations, Super-Seal motors have shown endurances that even enclosed motors couldn't match. Results and reasons available from your A-C representative or distributor. Or write General Products Division, Milwaukee 1, Wisconsin

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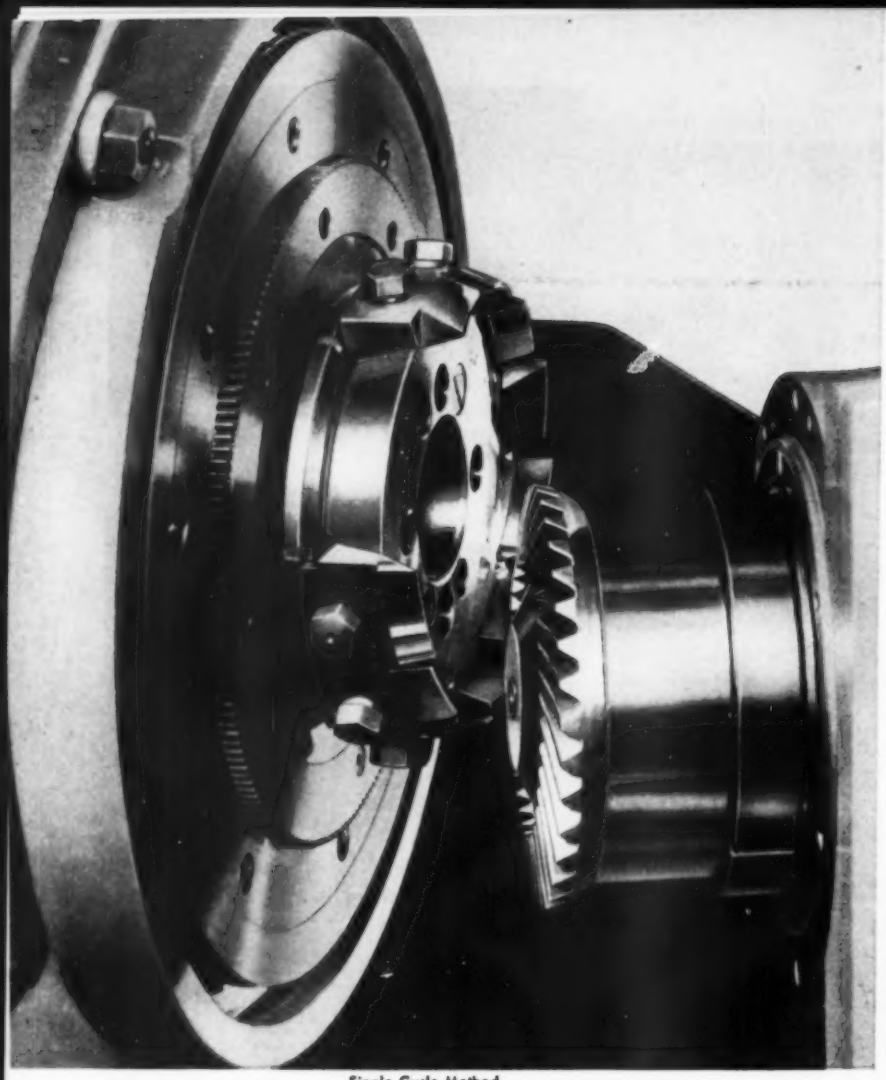
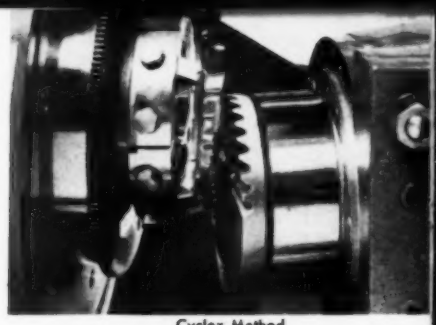
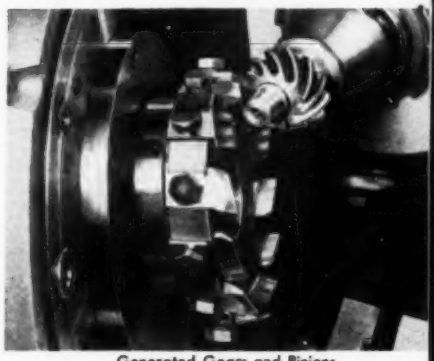
ALLIS-CHALMERS A-C A-1151



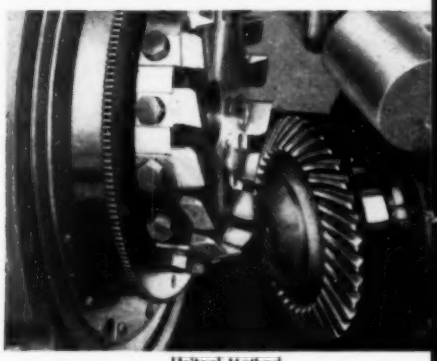
Single Cycle Method



Cyclex Method



Generated Gears and Pinions



Unitool Method

Cut gears with *four* different methods on *one* machine

If you expect your gear needs to change over the years you'll appreciate the exceptional versatility of the Gleason No. 108 Hypoid Generator. With this one machine you can cut both gears and pinions by four different methods:

Single Cycle® Method. Using this method you can cut nongenerated gears four to five times faster than previously possible on machines of this type. Cradle and work head are locked in position. The last rotation of the Single Cycle Cutter finishes both sides of a tooth space. You cut the mating pinions on the same machine using the conventional single-roll Generating Method.

Cyclex® Method. For certain applications you can use the extremely fast Cyclex Method on the No. 108 Generator. You cut nongenerated gears in one completing operation from the solid blank.

Generated Gears and Pinions. You can produce both gears and pinions on this machine with the Generating Method. Here, a relative rolling motion takes place between gear or pinion and the rotating cutter.

Unitool* Method. If you want to cut small quantities of spiral bevel, Zerol® bevel, or hypoid gears with a minimum of tooling, you can use the Unitool Method. You cut both gears and pinions with a single cutter. This method is particularly useful for experimental gears for prototype work.

The No. 108 Generator cuts gears up to 8½" diameter at a 10:1 ratio and to a maximum of 4 DP. You can get the same versatility in cutting larger gears with the No. 118 Hypoid Generator which handles gears up to 18" diameter, 10:1 ratio, to a maximum of 2 DP. A third model, the No. 28 Hypoid Generator, cuts gears up to 33" diameter at 10:1 ratio, 1½ DP.

Send for free bulletins on all three machines.

*Trademark

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CIRCLE 354 READER SERVICE CARD

MACHINIST
. . . THEY ALL AGREE
INSPECTOR
ON BATH QUALITY
PRODUCTION MANAGER
. . . when it's a matter of TAP and GAGE precision!
PURCHASING AGENT!

STANDARD HAND TAPS

High Speed Steel
Ground Thread

- Two and Three Flute
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- Spiral Pointed
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PLUG, CYLINDRICAL and THREAD GAGES

- **RING THREAD GAGES and INTERNAL MICROM-ETERS**

Selection of taps and gages on the basis of the lowest initial cost often results in the highest production cost . . . a fact that is known by every "thinking man" on this important panel.

They know they can save time and money with fewer rejects due to the uniform accuracy of the BATH line of standard and special cutting tools . . . and gages!

Another outstanding BATH feature is the availability of BATH engineering service . . . always ready to help solve tap and gage problems, big or small. Ask for the new BATH catalog on your business letterhead.

LOOK FOR THE BLUE BATH BOX!

DISTRIBUTORS IN ALL INDUSTRIAL CITIES

(See listing in June 15, 1959 Tool Engineer Supplier's Directory Issue)

JOHN BATH & CO., Inc.
22 Mann St., Worcester, Mass.

FOR THE BEST BUY. . . BUY BATH!

Announcement of Major Significance

FOR EVERY USER OF SOCKET HEAD CAP SCREWS

Following exhaustive studies begun in 1954, the socket screw products industry adopted, on April 24, 1959, new dimensional standards for socket head cap screws. Standard Screw Company participated in these studies and concurred in the recommendations approved by leading fastener manufacturers.

Adoption of the new standards, to be known as the "1960 Series", has important implications for every user of socket screws. As a public service Stanscrew will point out these implications . . . not only in relation to its own products, but also to the overall program of the industry.

Differences, Advantages Of New Design

The "1960 Series" has been carefully engineered so there is functional uniformity for all sizes, particularly as it applies to wrenching areas and to the relationship of head diameters to body diameters. For most sizes, as illustrated, this means substantial increases in both head diameter and socket size, and thus provides these advantages over the present design:

1. *Maximum utilization of the fastener's inherent strength . . . larger wrenching area permits application of greater clamping force.*
2. *Increased bearing surface under the head . . . up to 233% more.*
3. *Minimum indentation . . . particularly important with softer metals.*

Should You Convert Now?

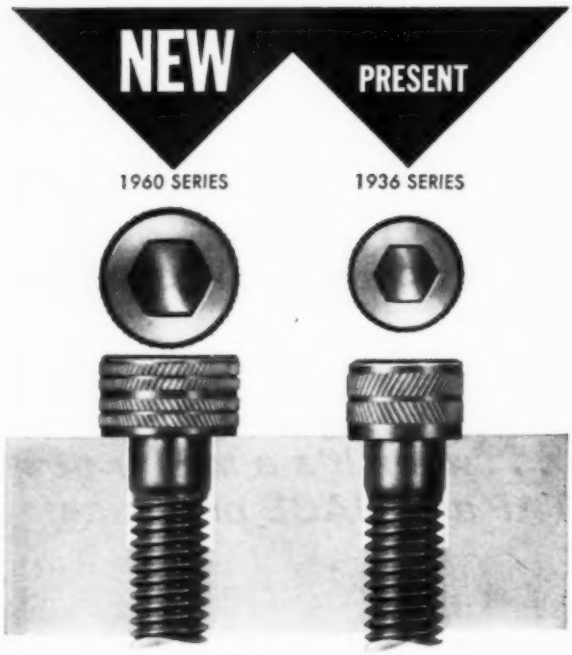
Obviously, for many applications, the new design offers important benefits which indicate conversion as rapidly as possible. In some cases, however, existing product design may not accommodate the larger heads . . . or, where socket cap screws are countersunk, revising your countersinking operations may create significant production problems. Stanscrew urges, therefore, that each company learn complete facts on the fastener industry's future plans.

Timetable For Industry Changeover

Stanscrew has already started production of the new "1960 Series". Manufacture of the present (1936) series will continue, however, and they will be available as standard, in-stock items until at least January 1, 1961. At that time, it is now contemplated the "1960 Series" will become the accepted standard throughout industry and the "1936 Series" will then be furnished only when specifically ordered.

When Designing A New Model

For products now on the drawing board, this timetable indicates many manufacturers should plan to use the "1960 Series" as the standard for later production. By making such design provisions, you assure maximum acceptance and minimum difficulty in the future.



For Existing Products

For many existing applications, where socket cap screws are not countersunk, either the 1936 or the "1960 Series" may be used. In frequent cases, improvements of the 1960 design suggest conversion within a short period. In other applications, where the heads are countersunk or where the greater head diameters of the "1960 Series" create a problem, changeover should probably be postponed until a general redesign of your product is scheduled.

Special Stanscrew Marking

To further distinguish its "1960 Series", Stanscrew will knurl heads of all new style socket cap screws with a split herringbone design (as shown). This special marking and the new "1960 Series" box labeling will provide quick identification of these quality fasteners.

For Further Information

Your Stanscrew distributor has the latest facts on the new "1960 Series" and will be happy to discuss them with you. If desired, he also will arrange for a prompt visit from a Stanscrew fastener specialist who will be most happy to go over all aspects of this new industry program as it regards your own particular operation.

Stanscrew also has a new brochure which provides complete dimensional and design data on the "1960 Series". No obligation, of course, for your copy.

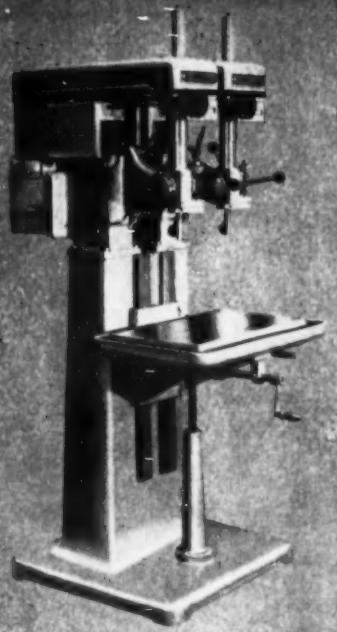
STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

EDLUND

The Greatest Advance in Drilling and Tapping Machines in the Past 25 Years



Edlund Model 1F

Sensitive machine for small parts and components.

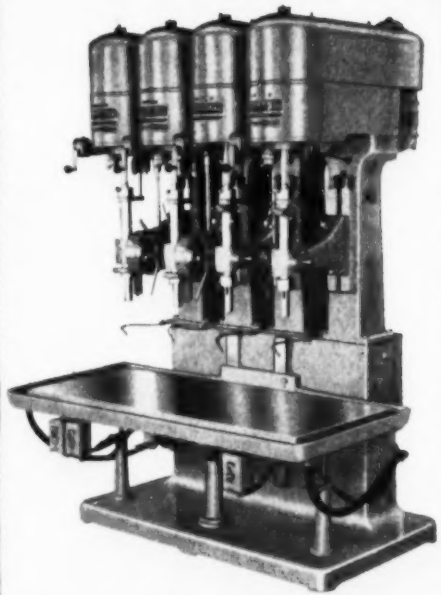
Infinite selection of speeds to 10,000 rpm

7" & 10" Overhang

⅝" Capacity

Pedestal and Bench models

Write for Bulletin 160 R



Edlund Model 2F

A top production machine for medium to heavy drilling and tapping.

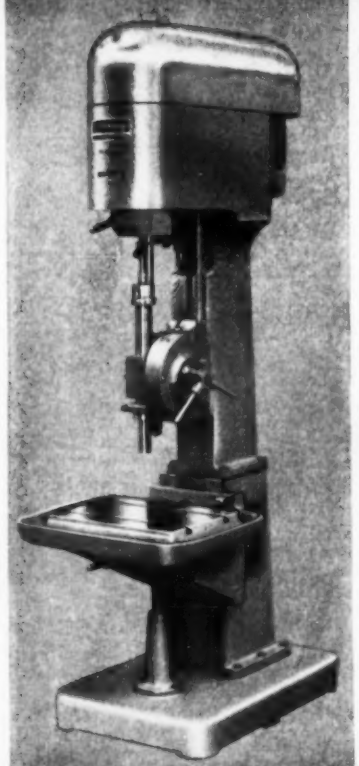
Infinite selection of speeds to 3,600 rpm
8"–12"–15" Overhang 1¼" Capacity

Pedestal and Round Column types

Write for Bulletin 140R

EDLUND REPRESENTATIVES IN MAJOR CITIES

CIRCLE 357 READER SERVICE CARD



Edlund Model 4F

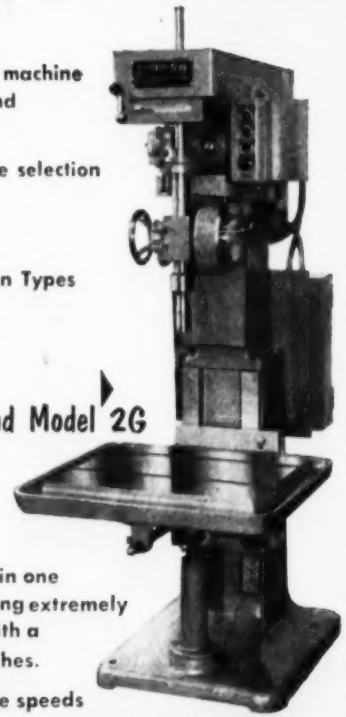
A work-horse production machine for heavy duty drilling and tapping operations.

1¾" capacity with infinite selection of speeds to 2200 rpm

12" Overhang

Pedestal or Round Column Types

Write for Bulletin 170 R



NEW! Edlund Model 2G

Vertical Gun Drilling Machine

Deep hole drilling up to 7½" at production rates in one single operation producing extremely straight smooth holes with a finish from 4-8 micro-inches.

⅜" Capacity with spindle speeds to 8000 RPM 12" Overhang

Write for Bulletin 2G

Write for FREE Descriptive Bulletins

EDLUND

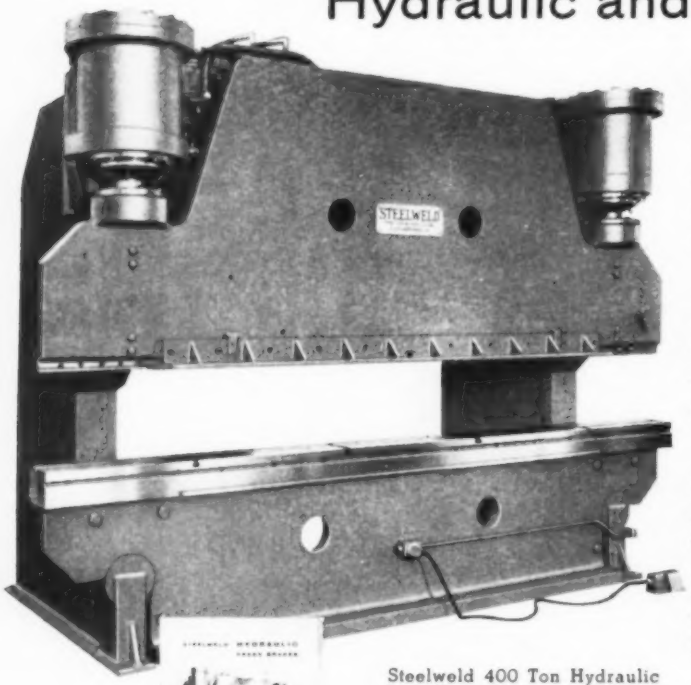
MACHINERY COMPANY

Cortland, New York

Division of Harsco Corporation

STEELWELD PRESS BRAKES

Hydraulic and Mechanical



Steelweld 400 Ton Hydraulic Press Brake. Bed and ram length 14'-0".

Hydraulic Press Brakes
Catalog No. 2024

Mechanical Press Brakes
Catalog No. 2023

WHATEVER your requirements, there is a Steelweld Press Brake—hydraulic or mechanical—to best serve your needs. Available in all sizes to 2000 tons. For plate thicknesses to 2". For lengths to 30'-0".

Each type of machine, mechanical or hydraulic, has its particular advantages. The work to be performed is the determining factor for most satisfactory machine selection.

As a manufacturer of both types of press brakes, we are in a position to offer you either one without partiality. Therefore, we urge you to get the complete story, the Steelweld story, when considering the purchase of a new brake. Ask for free catalogs.

Steelweld 320 Ton Mechanical Press Brake. Bed and ram length 12'-2".

STEELWELD
Mechanical and Hydraulic
PRESS BRAKES

Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

THE CLEVELAND CRANE & ENGINEERING CO. • 1475 EAST 281st STREET • WICKLIFFE, OHIO

PREVIEW OF PROGRESS

NICE BALL BEARING COMPANY
Division of Channing Corporation
Towamencin Township, Montgomery County, Pa.

NICE PLANS LONG RANGE PLANT EXPANSION

First Unit to be Completed in 1959

Nice Ball Bearing Company, Philadelphia, Pennsylvania, a Division of Channing Corporation, has started construction of a new plant addition to be located in Montgomery County, Pennsylvania, approximately 30 miles north of the present Philadelphia plant. The first unit, scheduled for completion in 1959, represents Nice's fourth major expansion since the end of World War II and will provide approximately 40,000 square feet of additional manufacturing area. Future plans for the new location call for an ultimate completely integrated plant of approximately 340,000 square feet.

An unprecedented demand for Nice products has created a critical need for additional facilities. Completion of the new facilities now under way will add substantially to manufacturing capacity and will enable Nice to improve deliveries and provide better service to customers during the fourth quarter of this year.

One of the pioneers in the bearing industry, Nice Ball Bearing Company has been a nationally known manufacturer of ball bearings since 1902, producing bearings that are used in products throughout the world.

NICE

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA
DIVISION OF CHANNING CORPORATION

CIRCLE 359 READER SERVICE CARD

DURA-PLATE INCREASES DURABILITY OF CHROME-PLATED PARTS BY OVER 50%

Dura-Plate, the new Brown-Lipe-Chapin process, gives chrome-plated parts a new dimension in durability.

New Dura-Plate consists of a duplex nickel base *plus* a thicker layer of crack-free chromium. Two-thirds of the initial layer is semi-bright nickel which is columnar in structure. The remaining one-third layer is bright nickel with a laminar structure. On top of this is a layer of chromium up to five times normal thicknesses. Together these three elements provide a higher degree of resistance to corrosion than has ever been achieved by conventional processes.

After 18-hour CASS Tests and actual field surveys with Dura-Plated parts, results showed that these parts resisted corrosion up to 50% more than companion parts plated by conventional methods.

The brilliance of Dura-Plate plus its outstanding resistance to corrosion adds important sales advantages to consumer products and opens up new applications for chrome-plated parts.

OUTDOOR LIVING: Dura-Plated parts can withstand the rigors of the most severe climate conditions, making it ideal for outdoor furniture, grilles, and outdoor-living accessories.

APPLIANCES: The lustrous brilliance of Dura-Plate parts provide extra sales appeal to ranges, refrigerators, toasters, washers and dryers. Grease detergents and other household cleaning agents will not mar the beauty of parts plated with Dura-Plate.

AUTOMOTIVE: Sparkling trim of Dura-Plate will stand up under the punishment of salt, snow and water, providing longer lasting protection for the beauty of automotive bright work.

In addition to Dura-Plate, Brown-Lipe-Chapin offers mass production facilities for die casting, all metal stampings, anodizing, rolled sections, polishing and painting. For further information, call or write Brown-Lipe-Chapin, Syracuse, New York.

GM GENERAL MOTORS

RELIABILITY by BROWN·LIPE·CHAPIN

DIVISION OF GENERAL MOTORS CORPORATION

4-col. presses bristle with production boosting features

KRW has done it again! This time, the 25-1000 ton KRW line of 4-column, single action hydraulic presses has been modernized to set a new pace over a broad work range.

Bristling with newness, these smooth-acting machines are built to outperform even KRW's highly regarded, prior designs in a wide variety of assignments: Blanking, forming, punching, trimming, drawing, extruding, briquetting, straightening, pressure clamping, laminating and bonding.

Already acclaimed "a marked success," KRW's latest version of the 4-column press boasts numerous features to improve quality and increase productivity: Of rugged, welded steel construction, the crown, bed and sliding platen provide maximum resistance to deflection. Align-bored to automatically controlled tolerances, the sliding platen is guided on ground and polished columns which are closely fitted into the crown and bed.

Easy to adjust, KRW hydraulic systems assure instant, complete press control. Compactly designed, the pumping unit can be mounted at the top of the press or furnished for floor installation.

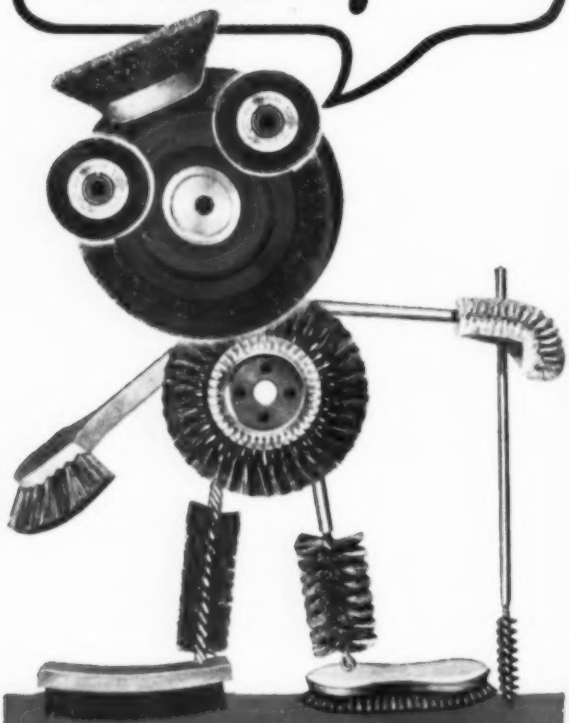
Available with either up-acting or down-acting platens, KRW 4-Column Presses can be outfitted with manual lever or electric push buttons for single or continuous cycling.

For detailed information and specifications, write for Bulletin 95-D. K. R. Wilson, Inc., 212 Main St., Arcade, N. Y.

KRW HYDRAULIC PRESSES

CIRCLE 361 READER SERVICE CARD

Take me to your buyer ...I'm the leader!



• Want to bring your brush costs down to Earth? Pittsburgh's complete line of power-driven and hand brushes... for any job, in any industry... can lead the way.

• For the address of your Pittsburgh Brush supplier, write or CALL COLLECT, Pittsburgh Plate Glass Co., Brush Div., 3221 Frederick Ave., Baltimore 29, Md.

PITTSBURGH PLATE GLASS COMPANY

CIRCLE 362 READER SERVICE CARD

COMMANDER TAPPERS

a Type and Size for Every Job!

Commander Tappers are made in 10 models —each designed to handle tapping jobs over a wide range. From the Commander Tapper line, you can select the right unit to give you the exact performance your job requires. Whichever Commander Tapper you select, you will get unequalled performance and tapping economy. Sold and serviced by drilling and tapping specialists. Write for the Commander Production Tool Catalog and name of nearest Distributor.

101

Commander MFG. CO.

4228 WEST KINZIE STREET • CHICAGO 24, ILLINOIS

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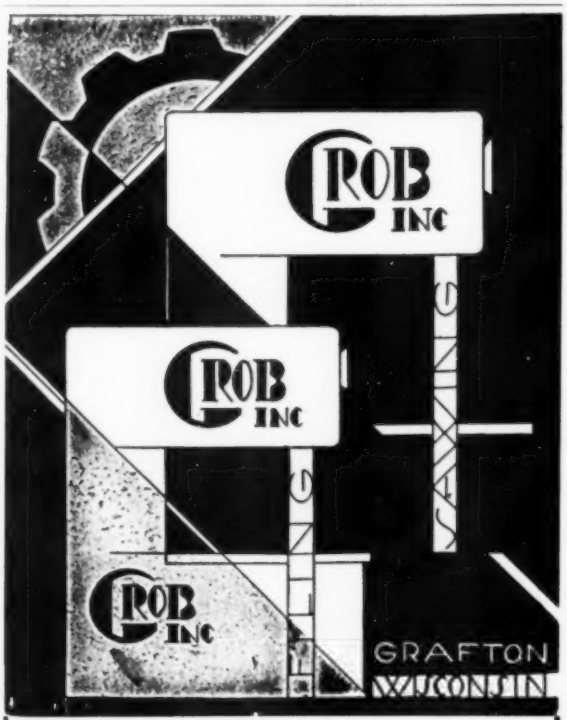

Machines for Filing, Sawing, Gear & Spline Rolling.

CIRCLE 364 READER SERVICE CARD

DIEMAKERS...

Cut costs here

Free-machining DESEGATIZED® HIGH ALLOY DIE STEELS

4

grades regularly stocked for long-run die applications...

- **OLYMPIC FM** (Type D-2)
  ...for typical long-run applications
- **BR-4 FM** (Type D-7)
  ...for extreme abrasive service
- **GSN FM** (Type D-3)
  ...to meet non-deforming requirements
- **COBALT CHROME FM** (Type D-5)
  ...for extra resistance to galling and pickup

Latrobe's 12% chromium die steels are easier to work, easier to machine . . . because they contain evenly-dispersed, fine alloy sulphides which permit faster speeds and feeds, and result in better machined surfaces.

As a result of Latrobe's DESEGATIZED process of manufacture, these steels are fully-uniform . . . free of harmful carbide segregations. They're tougher, respond readily to heat treatment, and possess unusual wear resistance characteristics.

For better die steels and technical service, call your Latrobe representative today!

LATROBE Metalmasters

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

BRANCH OFFICES and WAREHOUSES:
BOSTON • BUFFALO • CHICAGO • CLEVELAND • DAYTON
HARTFORD • LOS ANGELES • MIAMI • MILWAUKEE • NEW YORK
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Be Sure to Visit BOOTH 1350 at the 41st National Metal Exposition

Eyes Are Expensive Targets

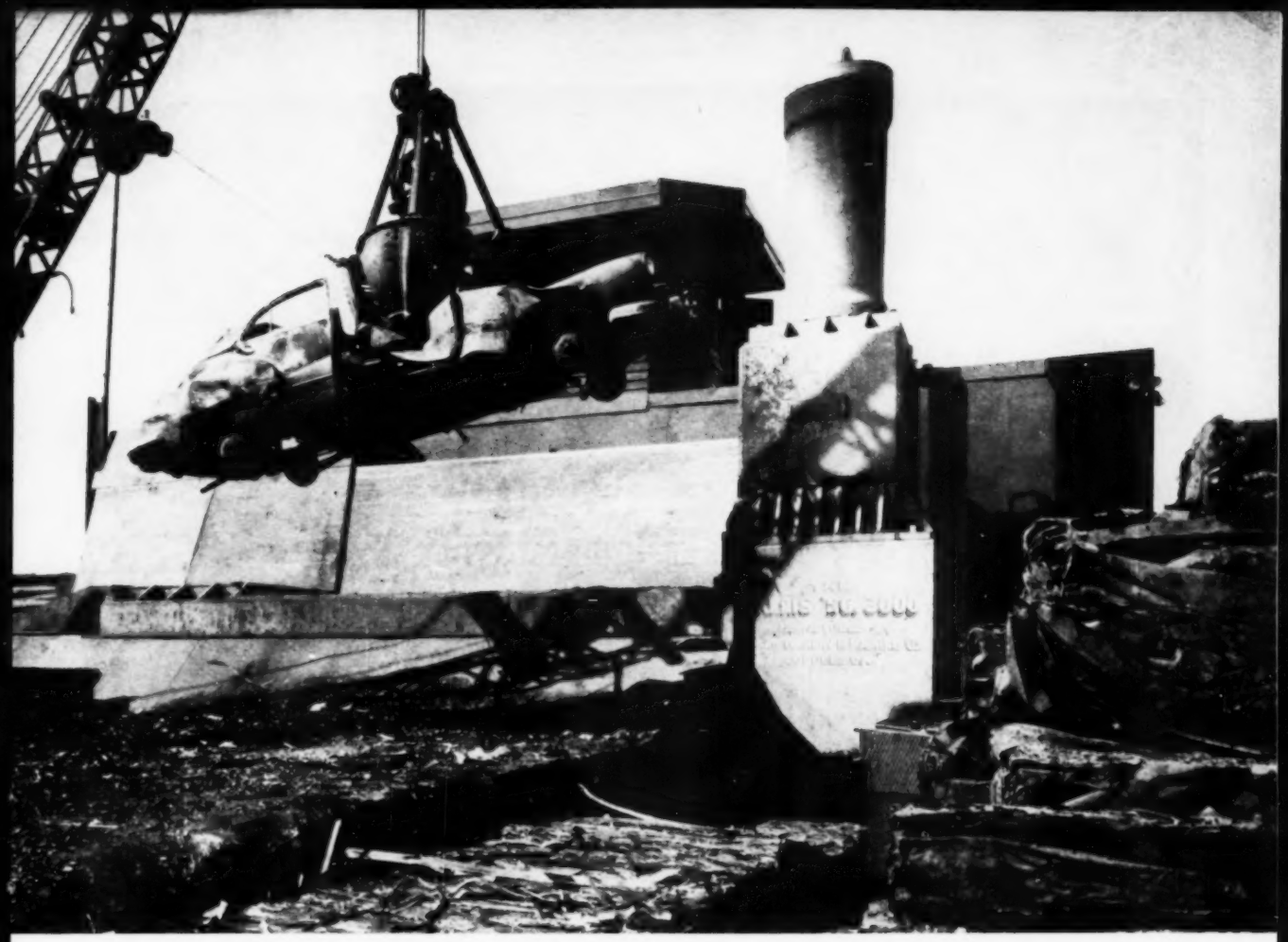
THE AVERAGE EYE INJURY COSTS INDUSTRY $6.00 PER PRODUCTION WORKER PER YEAR...THAT'S MORE THAN TWICE AS MUCH AS THE AVERAGE COST OF THE SAFETY GLASSES THAT PREVENT INJURY

*In some cases over $100,000 annually

Write for your copy of new brochure "Eyes are Expensive Targets." Shows how America's leading companies are saving workers' eyes (and skills) and thousands of dollars* annually.

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities

Always insist on Trademarked Lenses and Frames

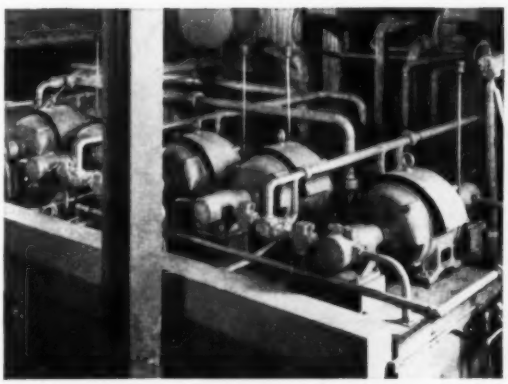


Smashing ¾ ton autos into 5 ft. bales

In a scrap salvage yard in Chicago, this huge press smashes automobiles into five-foot bales. Here's how it works. Stripped autos are shoved into a 20-foot press box. At the flip of a switch three giant plungers jam down with a force of over 1000 tons. Result: A compact bale, five feet long and two feet deep. About 30 cars an hour are run through this giant baling press.

Powering this mammoth machine requires sturdy motors. They have to deliver an instantaneous surge of power to drive home the huge plungers. Five Century Electric 100 hp motors do the job. Result: Plenty of dependable power when and where it's needed.

Century Electric application engineers have helped develop thousands of motor drive systems like this. And they can design the right drive system for your equipment because Century Electric designs, manufactures and applies motors and nothing but motors . . . your assurance of getting *more* than just a motor.



Five 100 hp Century Electric motors provide dependable muscle power for the huge press.

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

59-9

CIRCLE 367 READER SERVICE CARD

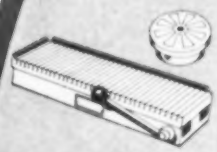
O.S. Walker

a new line of *Demagnetizers* by the originators of "engineered demagnetization"*

A complete line of demagnetizers from standard portable models to highly engineered magnetic amplifier controlled and compensated resonant units. • Standard units available for conventional use. • Special adaptations for automated production procedures. • Instruments for establishing residual magnetism tolerances and production inspection. • Engineering and laboratory facilities available for analysis of your demagnetization problem. • New approaches to demagnetization through Walker engineering research and experience.

*"Engineered Demagnetization" is the practical reduction of residual magnetism to specific tolerances. Send us your demagnetization requirements and let us recommend the lowest cost demagnetizer to do the job.

O.S. WALKER COMPANY, INC.
WORCESTER 6, MASS.



• Permanent magnetic chucks, 6 x 10" to 12 x 24", and rotary chucks from 4" to 48" dia.

• Electro-magnetic chucks, in 172 sizes, 4 x 8" to 36 x 96", and from 6" to 122" dia.

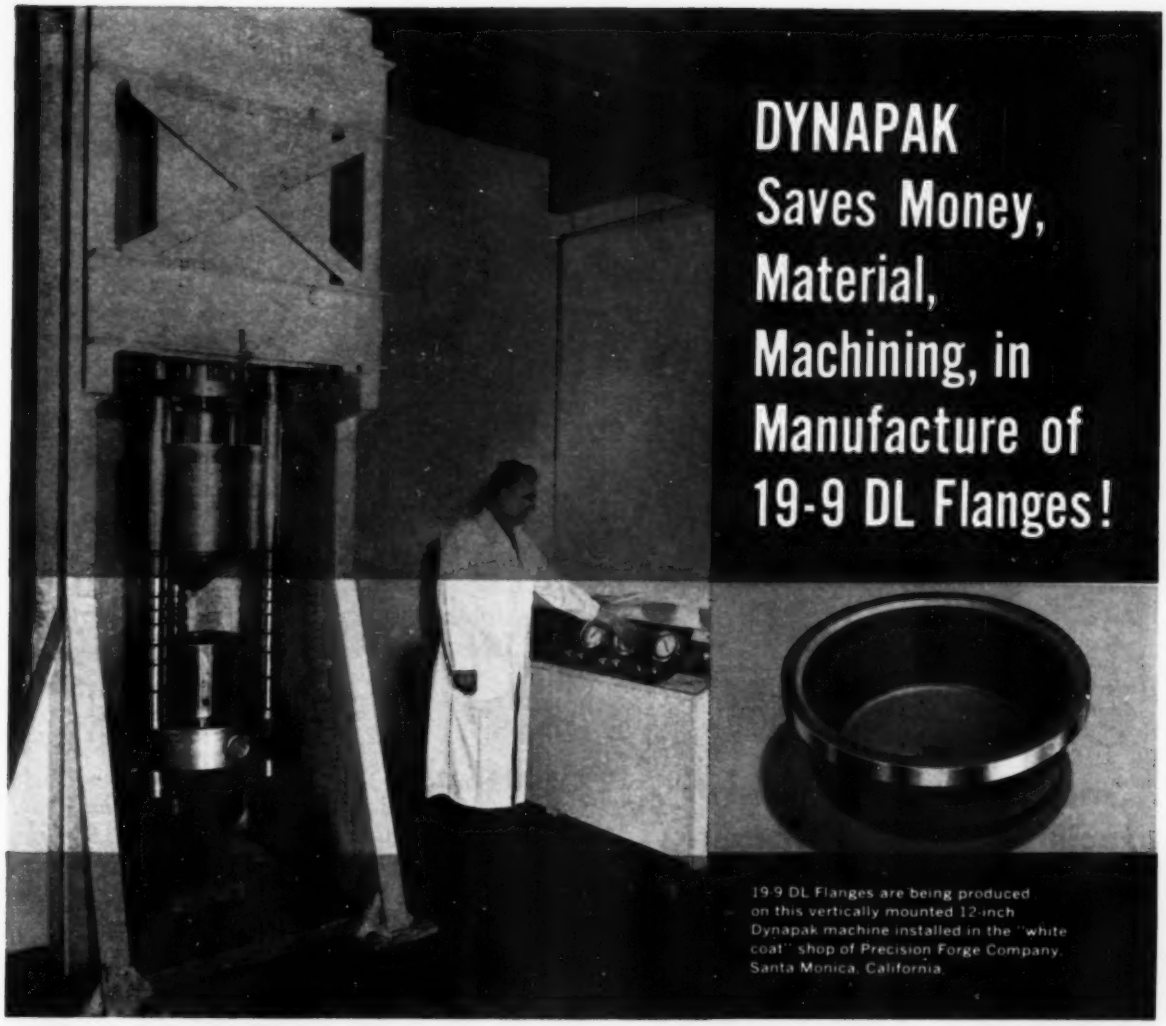
• Standard and special demagnetizers, and instruments for measuring residual magnetism.

• Bar pole electro-magnetic chucks, in 81 sizes, 6 x 12" to 36 x 96". Concentric gap chucks in 7 sizes, 6 x 12" to 12 x 24".

• Vacuum chucks in any size and shape for holding non-ferrous parts.

• Special electro and permanent chucks and magnetic holding fixtures are a specialty at O. S. Walker.

O.S. Walker—The Original Designers and Builders of Magnetic Chucks!



DYNAPAK Saves Money, Material, Machining, in Manufacture of 19-9 DL Flanges!

19-9 DL Flanges are being produced on this vertically mounted 12-inch Dynapak machine installed in the "white coat" shop of Precision Forge Company, Santa Monica, California.

Here are the savings achieved in this Dynapak Application:

- **MATERIAL: 60%**
- **TOOLING: 50% of the cost of conventional forging dies**
- **MACHINING: Reduced by more than 50% due to forging tolerances of 1/32 in. and elimination of draft angle.**

PLUS

- **PRODUCTION RATES: 70-80 per hour**
- **SUPERIOR PHYSICAL CHARACTERISTICS: Greater strength, uniform and controllable work-hardening, Grain Size No. 11.**

Dynapak, industry's first operational high-energy-rate machine tool, offers a breakthrough in metalworking's long-sought goal to produce forgings that can be used with little or no machining. This flange is just one of many forgings now being produced commercially by Dynapak. For complete information regarding application of pneumatically-energized Dynapak in your forging, extrusion, forming, or compaction operations, write, wire, or phone:

DYNAPAK

CONVAIR / A DIVISION OF GENERAL DYNAMICS CORPORATION

1243 Transit Avenue, Pomona, California • Telephone: NAtional 3-1561

NOW...a new Rotary Table reads direct to 1 sec.!

New No. 2 Moore Ultra-Precise Rotary Table, developed by the builder of the Moore Jig Borer and Jig Grinder. Moore also offers you a rotary table which reads to 5 sec. and has overall accuracy of 6 sec.

...meets the demand for precision angular spacing never possible before

With the new No. 2 Moore Ultra-Precise 11-inch 2 sec. Rotary Table, you can provide the closest precision angular spacing needed today. It reads to 1 sec. and has an overall performance accuracy of ± 2 sec. throughout the entire 360°.

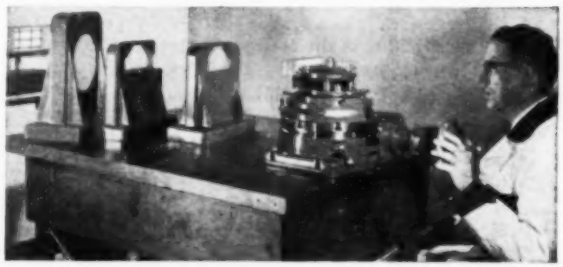
This kind of accuracy is achieved through the use of a nondisengageable, thread-ground worm in combination with the accurately spaced teeth of its mating gear. The worm and gear are burnished together to glaze and work-harden their perfectly matched contact surface. Loss of accuracy resulting from the repeated throwing in and out of the worm is eliminated.

A unique corrective lapping technique achieved by an ultra-sensitive method of angular measurement... interferometric inspection and calibration... produces tooth spacing accuracy within less than ± 2 seconds.

Accurate in either horizontal or vertical position, this new Moore Rotary Table is ideal for countless precision spacing applications on jig borers and jig grinders. Further applications are possible by using the table in conjunction with its companion unit, the Model No. 2 Sine Plate, to produce compound angle settings. *Write today for complete information about this new Moore table.*

GUARANTEED POSITIONING ACCURACY FOR SHOP USE

All points in 90° increments, from zero to ± 1 Sec.
All points in 18° increments, from zero to ± 1 ½ Sec.
All points in 2° increments, from zero to ± 1 ¾ Sec.
Worm accuracy — ¼ Sec.
Repetition of settings — ½ Sec.
Total error in any position — 2 Sec.
2 Sec. = 0.00005 (½ tenth) on 10" dia.



Accuracy assured by interferometric inspection and calibration. This is the first industrial division of the circle by light-wave measurement.

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Connecticut

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

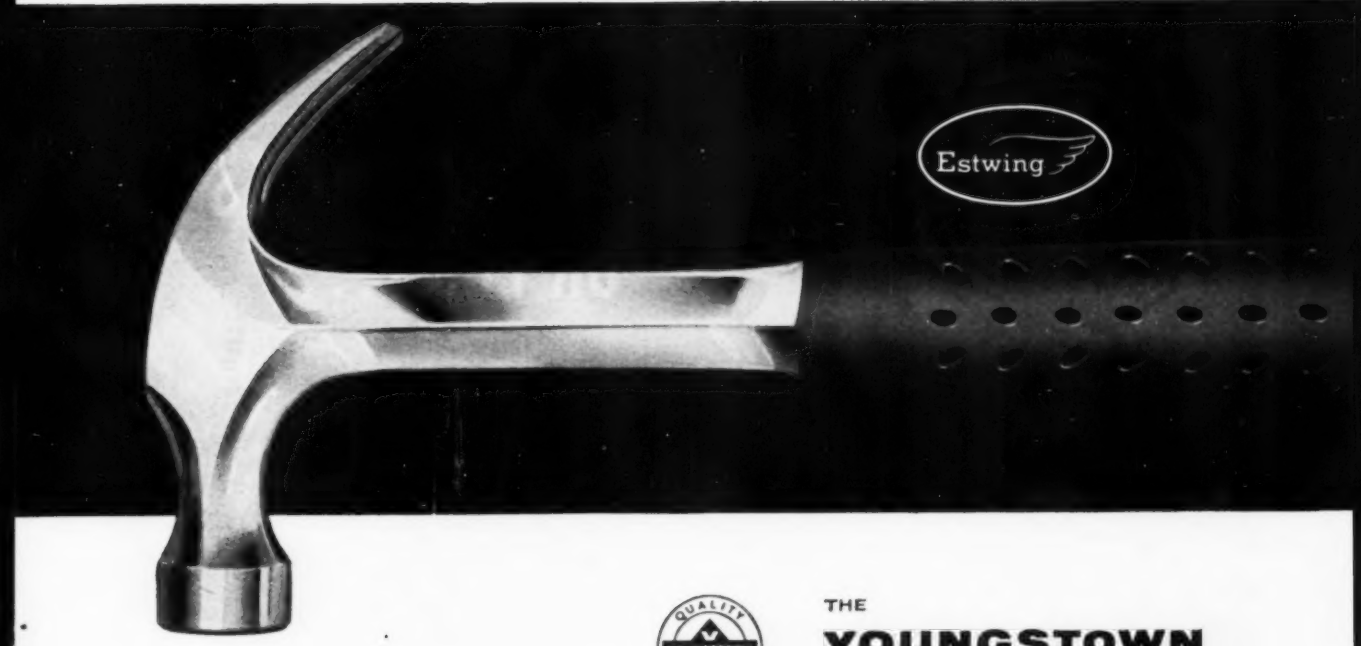
Accent on Excellence

Youngstown hot-rolled carbon bars

● When 35-year-old, nationally known Estwing Manufacturing Co. of Rockford, Ill., guarantees these handsome, newly designed curved claw hammers as *unbreakable in normal use*—they mean just that.

It takes steel of the highest quality to produce a hammer that can live up to such a guarantee. As a result, Estwing specifies Youngstown Hot-Rolled Carbon Steel Bars as raw material for the hammer's one-piece head-handle forging. It's never let them down.

Wherever steel becomes a part of things *you* make, the high standards of Youngstown *quality*, the personal touch in Youngstown *service* will help you create products with an "accent on excellence".



THE
YOUNGSTOWN
SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel
Youngstown, Ohio

CIRCLE 371 READER SERVICE CARD

NEW! ANOTHER BIG BONUS IN ALCOA SCREW MACHINE STOCK

With the exclusive new Alcoa Conversion Calculator, it's a snap to find total costs and resulting per cent savings in switching to aluminum screw machine stock . . . in just three minutes or less. This handy slide-rule calculator does all the mathematical computations! Just set the part length at the stock size and read out the pounds of brass and aluminum per 1,000 pieces . . . with *automatic allowance* for 5 per cent operating scrap, 3 per cent bar end loss and 0.103-in. cutoff and facing loss. Then, determine your local material costs and—zip!—you've got the gross rod or bar costs for both metals. The reverse side of the calculator gives you an equally fast answer for the percentage savings when you switch to Alcoa® Aluminum.

Call your Alcoa sales office or Alcoa distributor today for an Alcoa Conversion Calculator. You'll find them listed in the Yellow Pages of your telephone directory under "Aluminum."

Your Guide to the Best in Aluminum Value

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC-TV

ALCOA ALUMINUM

And don't forget those many additional bonuses when you deal with Alcoa:

- Alcoa Aluminum Screw Machine Stock allows up to four times higher cutting speeds than other materials—up to 1,000 sfpm speeds.
- Wider range of sizes in standard stock for important price advantages.
- Stock in specific 12-ft lengths at no extra cost . . . in rounds to 2⅞ in. and hexagons to 2 in. across flats.
- Chamfered ends at no extra cost in a wide range of sizes and alloys.
- A guaranteed market for up to 60 per cent of your turnings and borings from four aluminum alloys.
- An extensive mill inventory to back up the nationwide distributor stocks and cover emergency requirements of mill customers.

Alcoa Aluminum Screw Machine Stock Alloys:

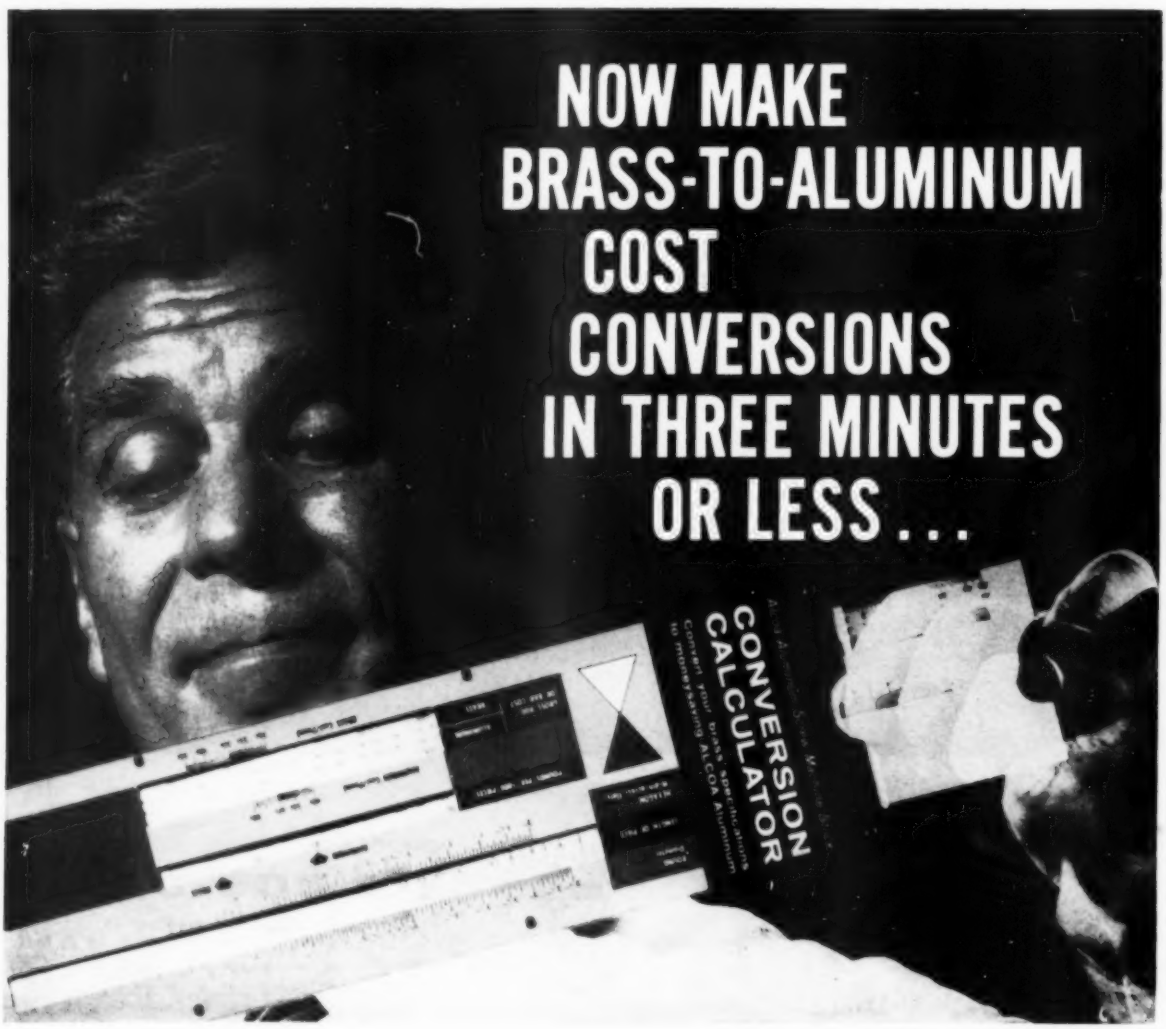
2011-T3: Tops in machinability. Frequently exceeds turning speeds of free-machining brass.

2011-T8: Designed for deep drilling operations. Maintains close tolerances.

2017-T4: One of the strongest alloys used for machine work. Chips readily controlled.

2024-T4: Exceptionally high strength. Cuts at high speeds and feeds for higher production rates.

6061-T6: Excellent finishes possible. Resists corrosion.

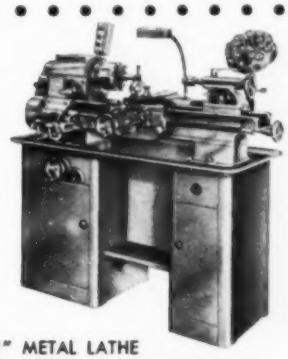


7" GRINDER
Also 6" Tool Grinder, 6" Bench Grinder

14" METAL-WOOD BAND SAW
Also 20", 14" and 20" Wood

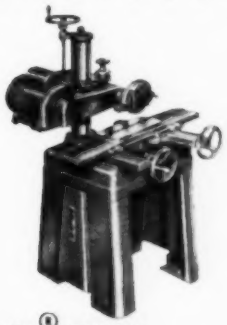
17" DRILL PRESS

6" ABRASIVE BELT FINISHING MACHINE
Also 12" Disc, 2½" Belt Grinder

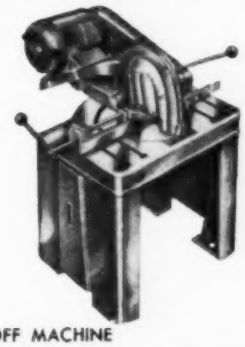


11" METAL LATHE
Also 10" and Hand Screw Machine

15" DRILL PRESS
Also 14" and 14" Super-Hi Sensitive



TOOLMAKER® GRINDER
Surface, Chipbreaker, Tool and Cutter



CUT-OFF MACHINE
Wet & Dry Abrasive, Non-Ferrous & Wood

20" DRILL PRESS

DELTA INDUSTRIAL TOOLS

a proved way to cut metalworking costs

You can match the tool to your job for bigger savings—supplement or replace expensive, special-purpose machines—when you choose from the world's most *complete* line—53 Delta machines, 246 models, over 1300 accessories. Delta tools cost less to buy, less to operate, and less to maintain. They offer precision performance to meet exacting requirements even under rugged, production-line use.

And because you can combine standard Delta components with automatic control devices, you can have the money-saving advantages of automation at a fraction of the usual cost. Ask your Delta Dealer about Delta "lo-cost automation"—and see the complete Delta line of tools and accessories—he's listed under "TOOLS" in the Yellow Pages.

FREE—Delta Industrial Catalog

Get all the facts on the complete line of Delta metalworking and woodworking tools and accessories. Write: Rockwell Manufacturing Co., Delta Power Tool Division, 618K N. Lexington Ave., Pittsburgh 8, Pa.

Visit Delta in Booth No. 1042
At the National Metal Show.

DELTA INDUSTRIAL TOOLS
another fine product by
ROCKWELL

CIRCLE 373 READER SERVICE CARD

(Advertisement)

OLIVER Template Tool Bit Grinder

Duplicates Precisely in One Operation

That's right! The Oliver Template Tool Bit Grinder sharpens single point tungsten carbide, high speed and stellite turning tools . . . duplicating exactly all original flats and radii every time the tool is ground . . . in one simple, efficient grinding operation.

How is it done? Well, as you can see from the drawing above the answer lies in "template control." The template at the top of the specially designed tool holder is a twice size replica of the tool form being ground. The tool, securely held at mid-point in the holder, contacts the wheel and is ground until the template touches the template stop. In this manner, the tool is ground to the *exact* profile of the template. The entire operation is performed in seconds — easily, accurately on one machine . . . a machine that pays for itself by reducing your tool inventory and by eliminating lost production time and tool breakage.

Want proof? Oliver will grind your tools on a "no charge" basis. Write today for full information. We'd like the opportunity of sending you a quotation.

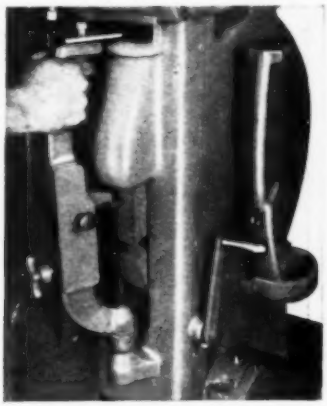
OLIVER of ADRIAN

1414 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES

How to add dividends to single point tools

The tool room can add four "dividend areas" through use of the Oliver 20" Template Tool Bit Grinder and can protect initial investment in tool bits. The dividends available to you are (a) rapid sharpening, (b) positive duplication, (c) grinding wheel economy and, (d) high salvage value.

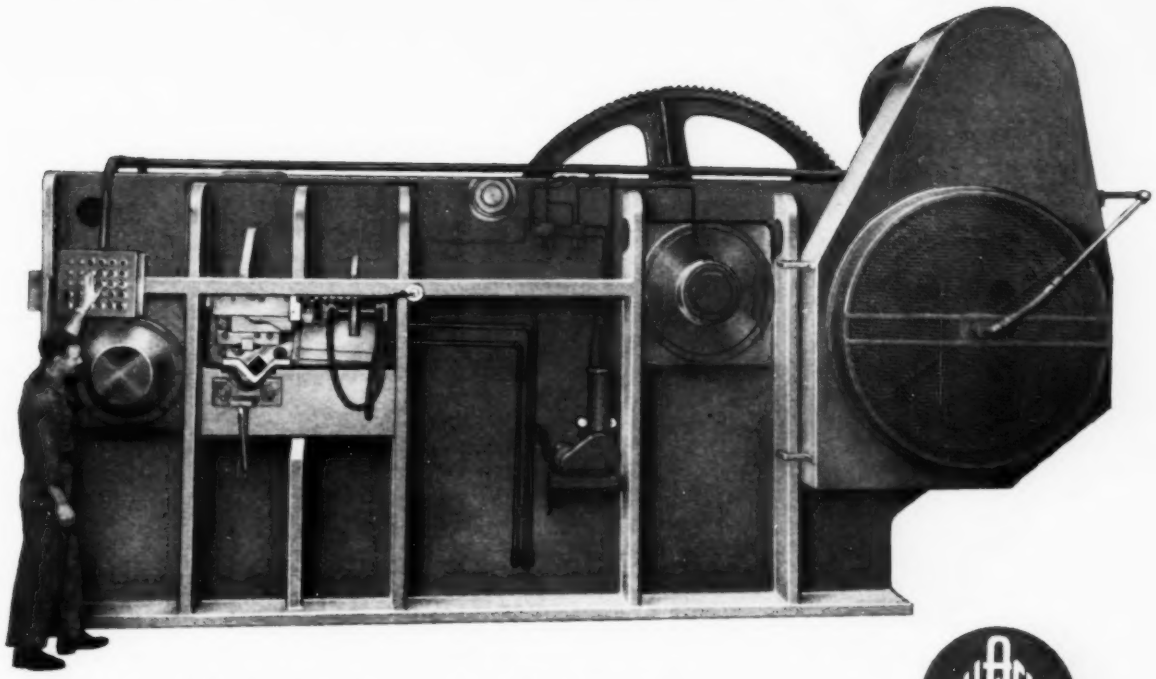


The total time involved in sharpening a tungsten carbide tipped tool bit is negligible. An average ¾" square tool calling for a total stock removal of about 1/32" is sharpened completely in approximately 30 seconds. This includes all angles, radii and soft steel support.

Positive duplication is readily assured. Once your tool engineer has determined the proper shape and clearance for best results, it is important that there be no guess work on subsequent grinds. The Oliver template control insures such a grind.

Grinding wheel economy is extraordinary. Practically all users have found secondary diamond wheel finishing of carbide tipped tools completely unnecessary. The 20" diameter silicon carbide wheel produces a micro-finish almost equal to that ground with a diamond wheel.

Your tool bits *can* have a high salvage value. It is common practice to discard tool bits when the carbide contains an area which has broken out for a considerable distance. The removal of the damaged area is quite expensive by ordinary grinding methods. The Oliver Tool Bit Grinder permits the removal of 1/8" or 1/4" of carbide in a minute or two, thus giving you new tool performance once again at a very low cost.



HILL ACME
HEAVY DUTY BAR-BILLET SHEAR
for production cutting of heavy billets

SIMPLE DESIGN The No. 1200 HILL ACME BAR-BILLET shear cuts large diameter squares of various tensiles. The basic principle of the lever and fulcrum is employed to insure maximum efficiency with low power input.

HIGH PRODUCTION With a free running speed of 26 cuts per minute the production of square, accurate lengths will appreciably reduce cutting costs.

VERSATILE Knives will accommodate many sizes of rounds, flats, squares or special shapes without the necessity of knife change.

LOW COST Initial machine cost is attractive and maintenance cost comparisons are impressive.

PROVEN EFFICIENCY Now proven through four years of successful operation in nationally known plants. Available with fully automatic, semi-automatic or hand feed.

SIZE RANGE HILL ACME BAR-BILLET shears are made in a range of sizes to efficiently accommodate every commercial requirement. Available in either right or left hand models.

Bulletin BB-59 gives complete details.

The HILL ACME Company

Also manufacturers of:
ROTARY SHEARS • "CANTON" ALLIGATOR SHEARS • HILL HYDRAULIC SURFACE GRINDERS • GRINDING & POLISHING MACHINES • "ACME" FORGING • TAPPING MACHINES • "CLEVELAND" KNIVES AND SHEAR BLADES • MECHANICAL LIFTERS

1201 West 65th St., Cleveland 2, Ohio

CIRCLE 375 READER SERVICE CARD 303

TAPER LENGTH REGULAR MILLING
TAPER LENGTH HEAVY DUTY HY-SPIRAL
HEAVY DUTY OR COTTER PIN DRILLS
LOW HELIX OR DRILLS FOR BRASS
HY-SPIRAL OR HIGH HELIX DRILLS
JOBBERS LENGTH COBALT DRILLS
DRILLS FOR PLASTICS
TEST RECORD

TEST after TEST

proves the economy of using CLE-FORGE SPECIAL PURPOSE DRILLS

Time after time CLE-FORGE Special Purpose Drills have clearly demonstrated their ability to produce *more holes* at *lower cost,* as proved by hundreds of actual tests in customers' plants. Typical records show that CLE-FORGE Special Purpose Drills . . .

. . . produce 10 times more holes per grind . . . increase production 80% . . . double the number of holes per grind . . . cut cost per hole . . . eliminate breakage . . . speed production at no increase in tool cost . . . average 13,000 more holes per grind.

These are not "special" tools, but are stock drills at regular prices . . . available for immediate delivery.

For greatest economy, CLE-FORGE Special Purpose Drills can be ordered with tangs (at no extra cost) and used with CLEVELAND Split Sleeves. Instead of paying for a taper shank on every drill, you get the needed length with a CLEVELAND Split Sleeve—which outlasts many drills.

If you have a problem of high drilling costs, perhaps a CLEVELAND Service Representative can help you solve it with CLE-FORGE Special Purpose Drills. Contact our nearest Stockroom, or . . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

for CLEVELAND ◇ Quality Tools . . . *prompt delivery from stock*

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York • Atlanta • Cleveland • Detroit • Chicago • Dallas • Los Angeles • San Francisco

ON THE BALL

500,000 TIMES A DAY BRIDGEPORT Free-Machining Brass Rod!

Because ball point pens are in everyday use, production of vital brass tips becomes astronomical along with quality control problems.

These tips – one of which is shown much enlarged – are produced at ultra-high speeds. The brass rod needed for them must be flawless in every respect. *Consistent* metallurgical composition, *precise* dimensional tolerances and *unvarying* standards of machinability – if any of these qualities vary even a fraction, production comes to a frequent and costly halt.

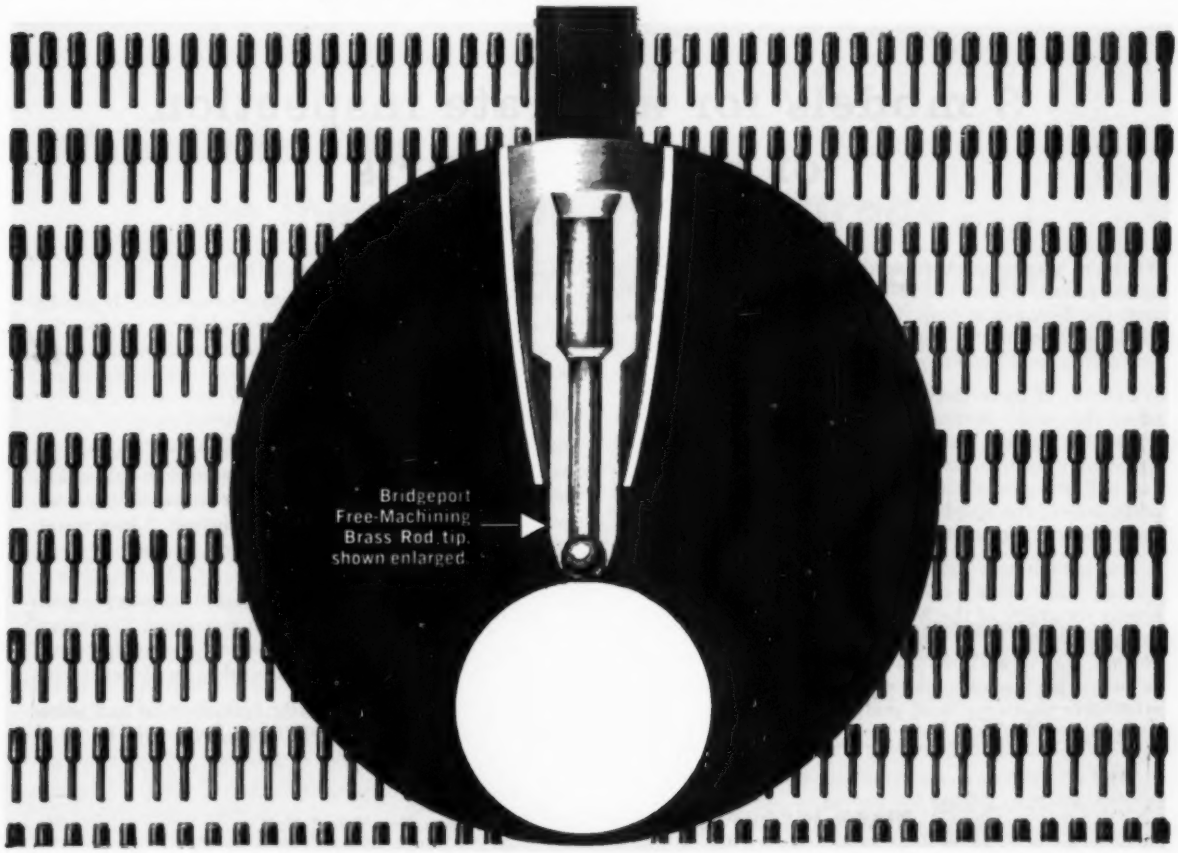
That's why Revere Metal Art Co., Inc., New York City, specifies Bridgeport Free-Machining Ball Point Pen Brass Rod for these inserts. It meets all requirements for precision, straightness, workability, machinability and tolerances –and, in addition, provides a surface finish that keeps finishing time and costs to a minimum.

Whether you use rod, strip or tube, you can count–just as Revere does–on getting consistent quality every time you specify Bridgeport Brass Alloys. It will pay you to get the complete story. Call your nearest Bridgeport Sales Office or write us direct for a complete list of Bridgeport products – Dept. 3012

BRIDGEPORT BRASS COMPANY

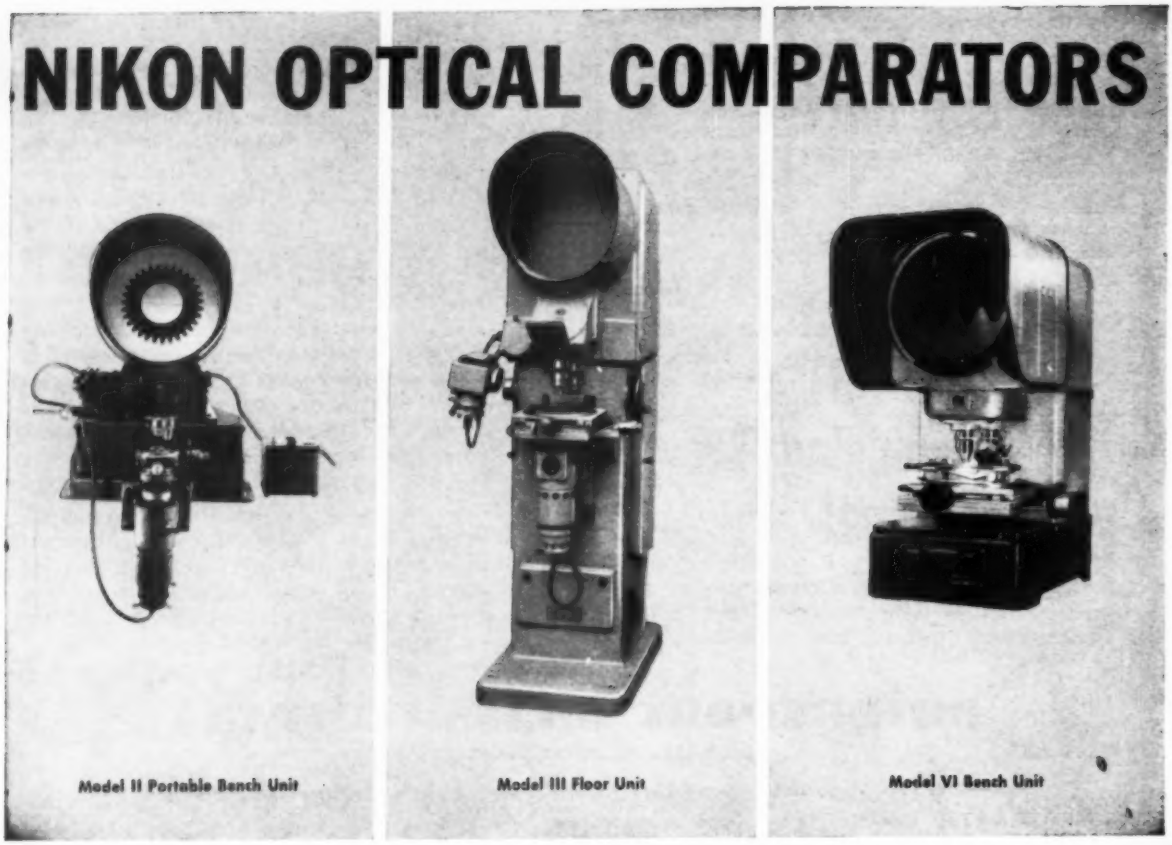
BRIDGEPORT 2, CONNECTICUT

Specialists in Metals from Aluminum to Zirconium



CIRCLE 377 READER SERVICE CARD

NIKON OPTICAL COMPARATORS



Model II Portable Bench Unit

Model III Floor Unit

Model VI Bench Unit

3 models for accurate inspection of precision parts

Whatever your inspection needs – whatever your budget considerations – there's a Nikon Optical Comparator to meet the demands of both. For Nikon has successfully fulfilled the two most pressing requirements in industry – *outstanding performance at moderate cost.*

Whichever of these three models you select, you will discover the same demonstrable qualities in each: bright screen illumination, sharp edge-to-edge definition, ease and speed of operation, and an almost unlimited versatility. You will be especially impressed with the high accuracy of performance, the simplicity of mechanical design, and the ruggedness of construction.

Nikon comparators may be used for surface as well as contour inspections – simultaneously, if desired. The inherent versatility of the Nikon is even further extended by the availability of a wide assortment of accessories for general and special applications: lenses covering a wide range of magnifications – 8 different stages – goniometers – fixtures – charts – vernier protractor screens – and photo-recording equipment.

NIKON Model II Portable Bench Unit –

Ready portability is one of its major advantages. It can be easily carried from one part of the plant to another for accurate on-the-spot inspections and measurements – with minimum loss of down time. Equipped with 3-lens turret.

NIKON Model VI Bench Unit –

Offers many advanced features: hand-wheel control for fine focusing, built-in illuminator for surface inspection, built-in blower system, bayonet mount for rapid lens interchangeability. Also available with bayonet, 3-lens turret.

NIKON Model III Floor Unit –

A rugged unit of extreme efficiency and accuracy – completely self-contained in cast aluminum housing. Fine movement focusing system employs lead-screw drive with scraped ways and adjustable gibs. Equipped with 3-lens turret.

For illustrated catalog, complete specifications and prices of all units and accessories, write to: Dept. AM-10.

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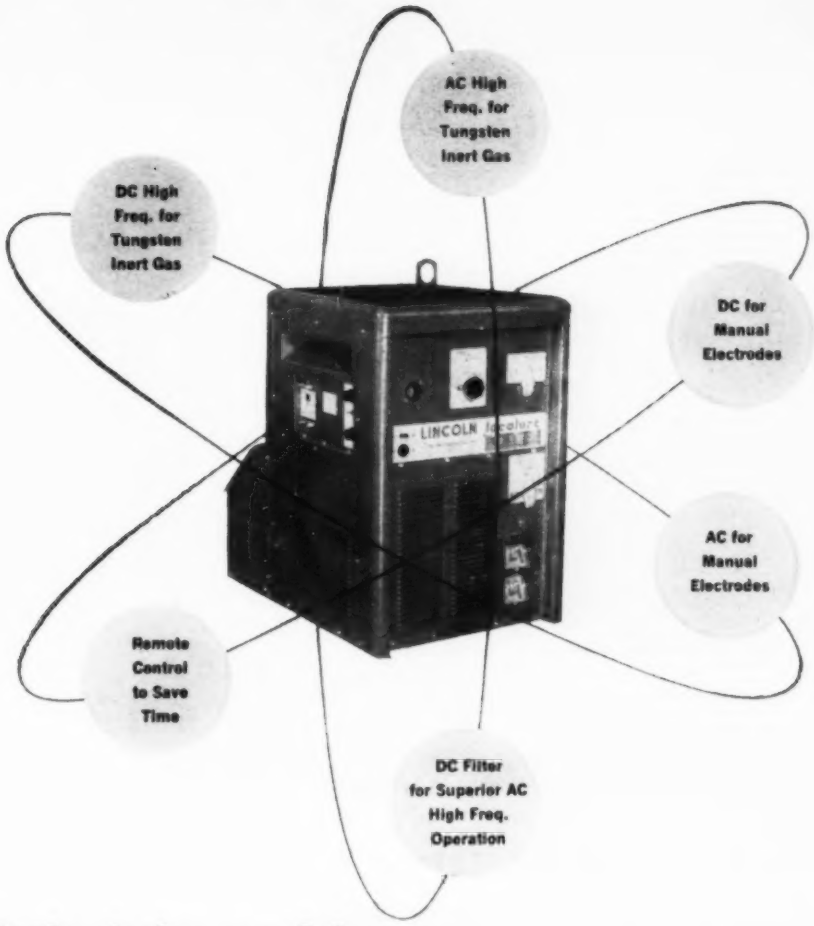

AC High Freq. for Tungsten Inert Gas
DC High Freq. for Tungsten Inert Gas
DC for Manual Electrodes
AC for Manual Electrodes
Remote Control to Save Time
DC Filter for Superior AC High Freq. Operation

Weld little jobs or big . . . use inert gas or stick electrode . . . on AC or DC welding current, with "IDEALARC TIG"

At last, here is a welder which gives complete versatility to maintenance-welding departments or to job shop operations. The "Idealarc TIG", equipped with high-frequency and water and gas controls can be used for welding stainless or aluminum. With just a flick of a switch, the same machine can do production welding with AC stick electrodes or pipe welding on DC.

But, if your operation does not require complete versatility, you can still have the superior welding qualities of the "Idealarc TIG" without all the optional extras. That's because Lincoln lets you select (and pay for), just the features you need.

The NEMA-rated "TIG" model has welding current ranges of 10-450 amps on AC and 10-375 amps on DC. For complete information, write to us for Bulletin 4608.1.

COMPLETE WITH:

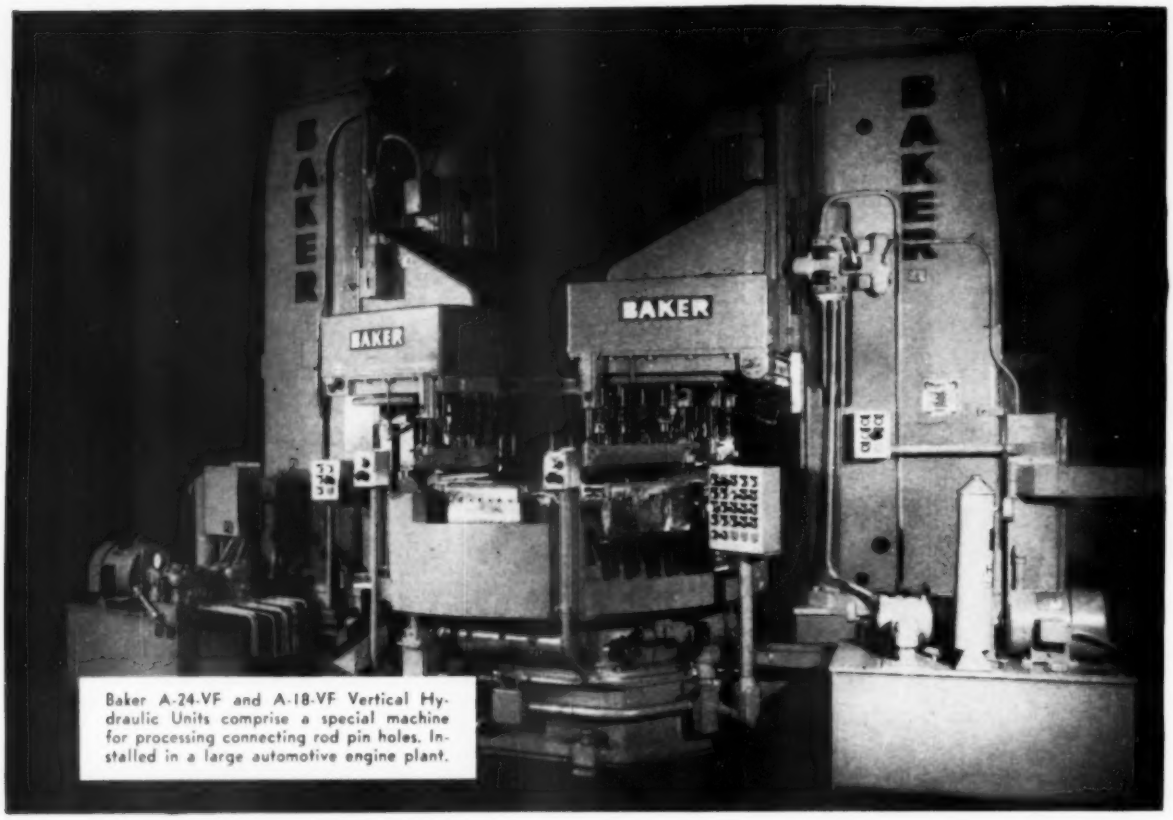
- AC and DC Current Selection
- High Frequency
- Gas and Water Controls
- Balanced Wave Filter
- Power Factor Correction
- Remote Current Control

Price: $1041 *(in Zone 1)*

LINCOLN ...USA

The world's leading manufacturer of arc welders and electrodes, ac motors and battery chargers.

THE LINCOLN ELECTRIC COMPANY • Dept. 2038, Cleveland 17, Ohio



Baker A-24-VF and A-18-VF Vertical Hydraulic Units comprise a special machine for processing connecting rod pin holes. Installed in a large automotive engine plant.

SPECIAL MACHINE BUILT WITH THE STANDARD BAKER® COMPONENTS

The job: Drill to one-half depth, drill through, ream and chamfer automotive connecting rod pin holes.

BAKER engineers came up with this cost-saving answer: 2 BAKER Standard Vertical Machines in combination with a new 7-position, 72" index table.

The table is driven from an outside source and is designed so that all components are removable from the outside without disturbing fixtures or table top.

Except for the fixture, all components are standard. The drilling heads are standard BAKER fixed center units, with special bushing plates. Production rate is 600 parts per hour gross.

If your plans call for special machines to be built within an economy budget, investigate the design versatility of BAKER Standard Hydraulic Drilling and Tapping Machines. Write to: BAKER BROTHERS, INC., DEPT. AS -1059, 1000 POST STREET, TOLEDO 10, OHIO.

BAKER®

STANDARD AND SPECIAL DRILLING AND TAPPING MACHINES • AUTOMATIC BAR MACHINES • COMPRESSION AND TRANSFER MOLDING MACHINES

Talking About Die Sets

with

Phil Marsilius

Executive Vice-President
The Producto Machine Co.

Die Set Maintenance in the Pressroom—The vital die-maintenance procedures required periodically when a die is removed from the press for sharpening should be coupled with systematic die set inspection and maintenance in the pressroom.

In addition to having a planned schedule of lubrication (based on any of the methods previously discussed in this space), you can make sure of getting the most out of your investment in die sets—and the costly dies and presses with which they are used—by following a simple set of procedures for inspecting and maintaining die sets in the pressroom.

Although there are no hard-and-fast rules that can be established for all die sets, the procedure listed below is generally followed at leading stampings plants in the East. These companies point out that die sets used in the cutting of extremely thin material or for very critical parts would naturally require a more stringent inspection than those used for blanking heavy material or for comparatively simple parts.

At one plant, specializing in long runs of close-tolerance parts for the electronics industry, the procedure followed is:

1. No inspection of the die set during production run unless, of course, there is overheating, pick-up on the guide pins or other obvious difficulties.

2. When the die is taken off the press for sharpening or maintenance, the die set is visually inspected for pick-up or score marks on either the guide pins or bushings. Pins and bushings are carefully cleaned to remove excess lubricant.

3. After approximately 1,500,000 strokes, the set is thoroughly checked for wear on both the pins and bushings. On the average, up to .0003″ wear on pins and bushings is allowed before replacement with new components is scheduled. In addition, the die set is placed on a surface plate and an indicator is placed over one end of the set. An attempt is then made to rock or twist the set by hand to establish how much the die set can be deflected. On a 10″ set, a maximum of .005″, but usually less, total deflection is allowed.

Because the die set plays such an important part in prolonging the accuracy and lifetime of a die, it pays to take the little extra time required to do justice to die set maintenance in the pressroom.

4. During regular or periodic regrinds, the die set is not checked for bent or distorted punch and die holders unless the die has been damaged or there is reason to believe the set may have warped.

During the overall period, if the pins and bushings are replaced, the punch and die holders themselves are checked for warpage or distortion. If necessary, these components are reground prior to assembling the new pins and bushings.

Why the pressroom foreman prefers Producto die sets

Four-stage blanking and shaving die, Lenkeit Machine & Tool Co., Inc.

They keep his downtime down

Keeping production *up* and downtime *down* is the main job of the pressroom foreman. He knows Producto die sets can help him do this job successfully because they maintain accuracy for long runs. All catalog steel sets are annealed to prevent distortion.

He is aware that Producto can provide him with any type of die set he needs—whether for standard or special presses—in a wide range of sizes and thicknesses, with or without clamping flanges.

The pressroom foreman knows that Producto guide pins are mirror-finished to eliminate scoring, and that Producto die sets are available with a variety of lubrication devices to keep them "running cool".

He knows, too, that he is not restricted to the use of predetermined press stroke or shut height because Producto offers an unlimited choice of pin and bushing lengths. Moreover, he can get the bolster he needs to protect his die at the same time he gets his die set. Both die set and bolster can be ordered in steel or cast semi-steel depending on strength requirements.

The pressroom foreman realizes that Producto Qwik-Fit Die Sets make "take-apart-and-put-together" easy during die maintenance. He also knows that Qwik-Fit removable pins and clamp-type bronze bushings are available when the application calls for them.

He can *produce more* with Producto die sets. So can you.

A WEALTH OF DIE SET KNOWLEDGE is packed into Producto's Catalog No. 11 and regular issues of *Die Set Digest*. Write today for these free aids.

THE PRODUCTO MACHINE COMPANY
965 Housatonic Avenue, Bridgeport 1, Connecticut

PRODUCTO

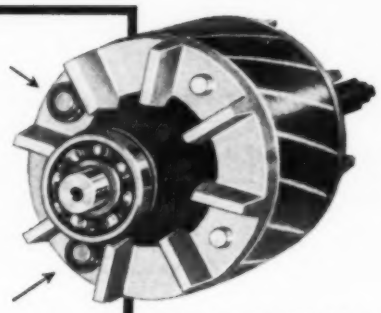
Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

Choose The Balancing Features That Meet Your Workpiece Needs EXACTLY on a Schenck

Completely efficient balancing is possible only on a balancing machine that can be adapted *exactly* to individual workpiece requirements. And this close correlation of method to part is possible only when you have a *complete* choice of various balancing methods.
Schenck Balancing Machines offer you not just a wide variety of balancing methods, but the particular type of each method best suited to your component.



Motor armature with precast bosses. Balance corrected with washers (arrows)

Unbalance correction method	manually			semi-automatic			fully automatic	
Unbalance indicating system	componential				vectorial			
Number of correction planes	one			two			several	
Balancing Sensitivity (micro inches)	1,000	100		10		1		.1
Balancing Speed (rpm)	100		1,000		10,000		100,000	
Drive method	belt		direct		air		own power	
Workpiece support	sleeve bearing		antifriction bearing		balancing fixture		own assembly	
Workpiece Weight (lbs.)	.01	.1	1	10	100	1,000	10,000	100,000
Workpiece Diameter (inches)	.1		1	10		100		1,000
Rotating Axis	Horizontal				Vertical			

Depending on your operation, Schenck can provide you with:

A highly efficient single-purpose machine.

An extremely flexible universal model.

Let us study *your* balancing program and suggest a Schenck machine adapted specifically to *your* requirements.

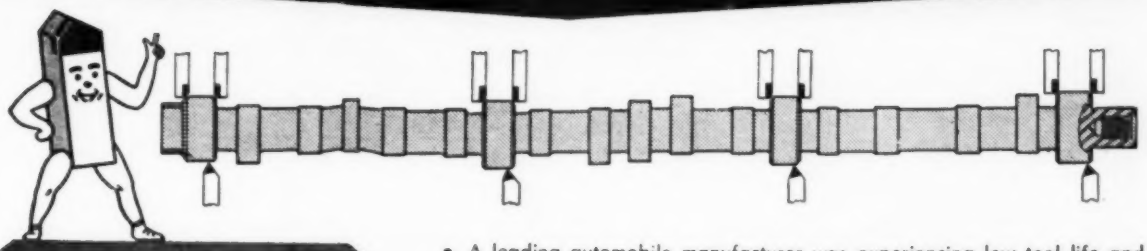
Write For More Information

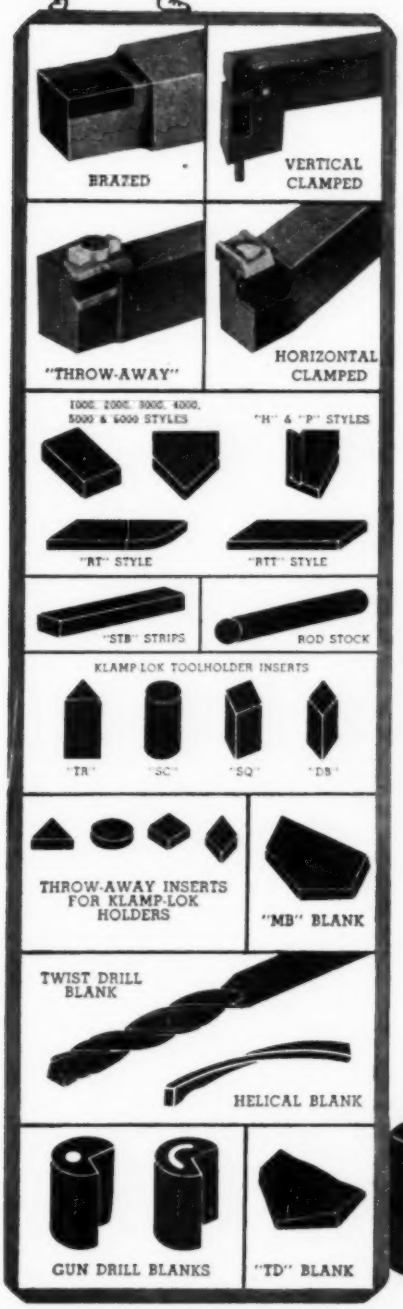
Model R-02 Schenck Balancer

COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

1020 CAMSHAFTS MACHINED WITH Talide® C-91!





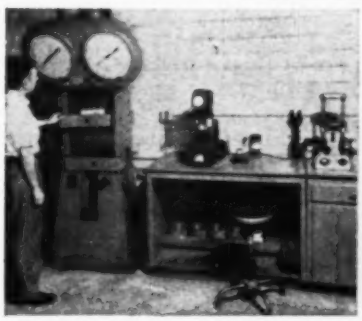
• A leading automobile manufacturer was experiencing low tool life and high costs machining camshafts made of tough, highly abrasive cast iron alloy. Talide tool engineers installed Grade C-91 with the following superior results:

GRADE C-91 CASE HISTORY

Part	Automobile camshaft	**Tools**	4 Talide TB-123⅛" I.C. x 1½" long triangular inserts, Grade C-91, mounted in Klamp-Lok toolholders
Material	Cast Iron Alloy 1.8165 dia. x 23½" long, 260 Brinell	**Depth of Cut**	1/16" to 3/32"
		Feed	.012
Operation	Rough turning 4 bearing surfaces	**Speed**	130 (S.F.M.) 274 (R.P.M.)
Machine	Sundstrand Model 28 automatic	**Coolant**	Soluble Oil

Results.... Talide Grade C-91 machined 1020 camshafts per grind compared to 550 for 2nd best competitive grade and 275 for 3rd best. Special attention to the grind and chip breaker detail resulted in Grade C-91 outperforming all other grades used previously.

QUALITY CONTROL GUARANTEES TOP TOOL PERFORMANCE...



Determining rupture strength of test bar. Hardness is determined on Rockwell machine, center.

Leco and Burrell instruments are employed in the analysis of metal oxides.

• A constant research program at Metal Carbides pays off in improved Talide grades having extra high hardness, strength, rupture resistance and crater resistance properties. Processed in latest type vacuum electric furnaces—all Talide grades are uniform and consistent in quality.

Write for Catalog 56-G

Metal Carbides Corporation Youngstown 12, Ohio

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

Larger Stocks of Johnson Standard Stock Bearings Are Available NOW from Your Johnson Distributor

Increased demand for Johnson Bronze standard stock bearings has been met by adding larger stocks of these quality bearings in warehouses across the nation.

Satisfied users of these bearings that meet tolerance requirements and allow maximum freedom of design testify to their quality . . . and the savings they provide.

Cost savings result from the economies of volume production and elimination of tool and die charges. *Time savings* result from fast shipments from distributor stocks.

Don't pay extra for special bearings you don't need. Take advantage of Johnson standard stock bearings. More than 900 stock sizes of these plain, whole bearings in 214 different ID-OD combinations and 21 lengths are yours to choose from. Johnson standard stock bearings can be supplied with slots, oil grooves or holes at slight additional cost.

If you are not benefiting from the economy and flexibility of Johnson standard stock bearings, write for full information including the name of your nearest Johnson distributor.

Johnson Standard Stock Bearings Are Available from . . .

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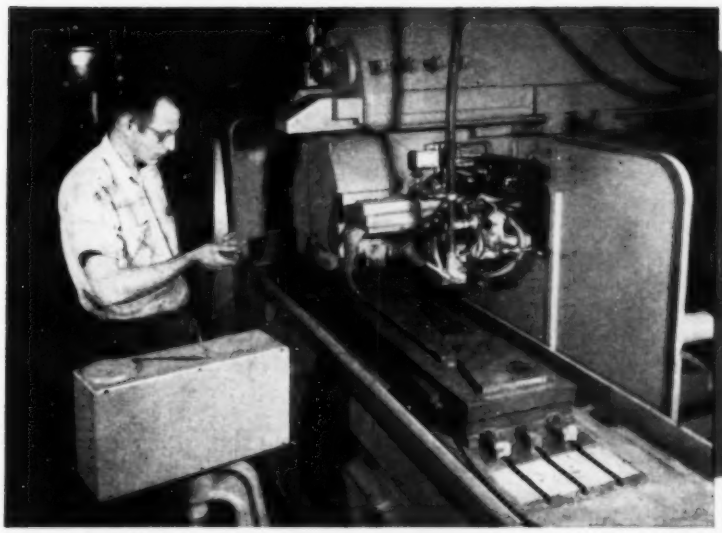
over 900 sizes

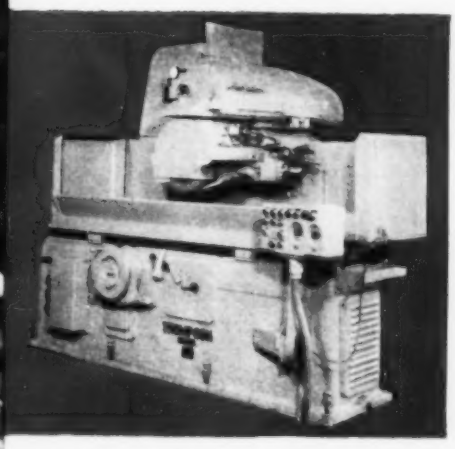
UNIVERSAL BRONZE BARS
over 400 sizes

POWDER METALLURGY
over 400 sizes

ELECTRIC MOTOR
over 350 sizes

THE NEW THOMPSON PLUNGE-MATIC SURFACE GRINDER





COMPLETELY AUTOMATIC

With the new Plunge-Matic, Thompson now offers a plunge feed machine for those surface grinding jobs where the area to be ground is constantly covered by the grinding wheel width. Designed for fast production, the Plunge-Matic is completely automatic—including downfeed, wheel dressing and automatic compensation.

Shown above is one of four Plunge-Matics in use at the Disston Division, H. K. Porter Company, Inc., grinding high quality hand saws. The saws are held on tapered flux bars or magnetic shims and the wheel face is dressed straight with an automatic power operated wheel truing device. The four machines are equipped with a pre-selected variable downfeed arrangement which automatically decreases the downfeed rate as the contact area of the work increases. The wheel heads are also equipped with oscillating crossfeeds. Being completely automatic in their cycles, the four machines require but two operators who load and unload only.

Constant Accuracy is Assured by Hydra-Cool

All Thompson Plunge-Matics are made in various types and sizes to meet all job requirements. All machines of 40 inches and up in work length are equipped with the Hydra-Cool Hydraulic System*—the exclusive Thompson feature which eliminates all heat distortion throughout the machine.

* PAT. APPLIED FOR

The new Thompson Plunge-Matics are designed to grind contoured as well as flat surfaces with equal efficiency. The three drawings at right represent but three of many contour jobs which Thompson Plunge-Matics are now handling successfully.

SPECIFICATIONS	
GRINDERS:	Thompson Type C 12"x16"x-48" Plunge-Matics
WHEELHEAD:	40 HP
WHEEL:	20"x8"x12"
STOCK REMOVAL:	Approx. .010" from each side
PRODUCTION RATE:	60 saws every 50 minutes from 2 machines with one operator

Send for descriptive folder on this new Plunge-Matic surface grinder.

Thompson SURFACE GRINDERS

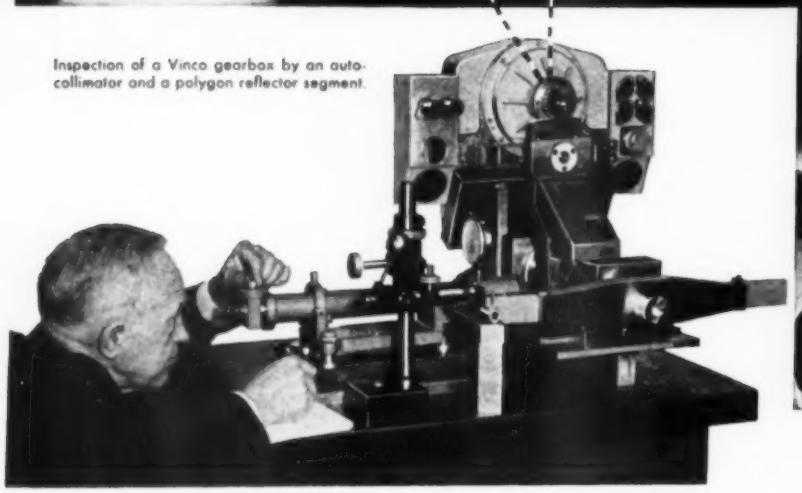
THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

CIRCLE 385 READER SERVICE CARD 313

MISSILES GEARED TO A STAR BY VINCO

Accuracy of 3.6 seconds of arc.
Gear ratio 2,584,800 ÷ 1.



Inspection of a Vinco gearbox by an autocollimator and a polygon reflector segment.

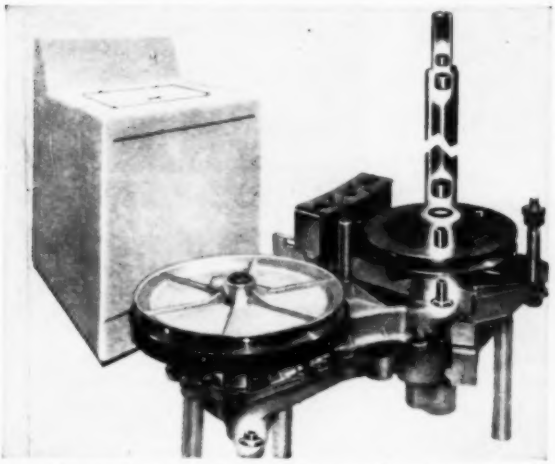
Test stands for missile guidance systems include a gearbox built by Vinco to isolate the gyro system from the earth's rotation. Driven by an 1800 RPM synchronous motor, with a gear head stepdown to 1RPM, it produces an output motion of one turn in one sidereal day. Output accuracy limit of 3.6 seconds of arc reflects the action of 8 Vinco gears and 9 precision ball bearings. It is equivalent to .00018" error of motion at the pitch line of a 32 diametral pitch, 20° pressure angle, 20.625 pitch diameter output sector.

Such accuracy is a must for checking the error or drift of gyroscopic and inertial guidance equipment. The gears in the sidereal rate test gearbox were ground and inspected on Vinco equipment by Vinco craftsmen. This personnel and equipment are available for producing gears of the same high precision for you.

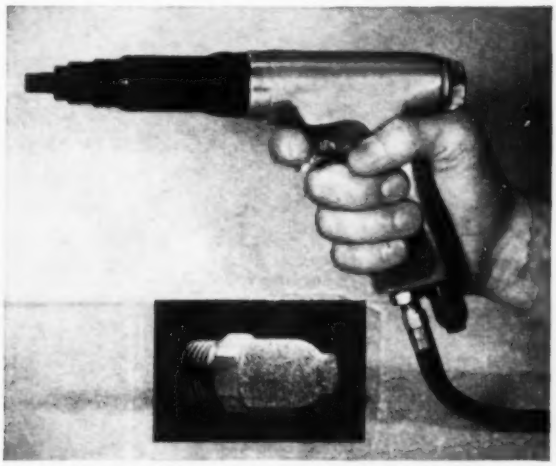
The Vinco Optical Master Inspection Dividing Head is the most accurate instrument of its kind for checking angular spacing. Accuracy is guaranteed within a total variation of 2 seconds of arc (± 1 second). This instrument is available in both standard and heavy duty models.

VINCO CORP., 9111 Schaefer Hwy., Detroit 28, Mich.

BOOST PRODUCT APPEAL with OILITE

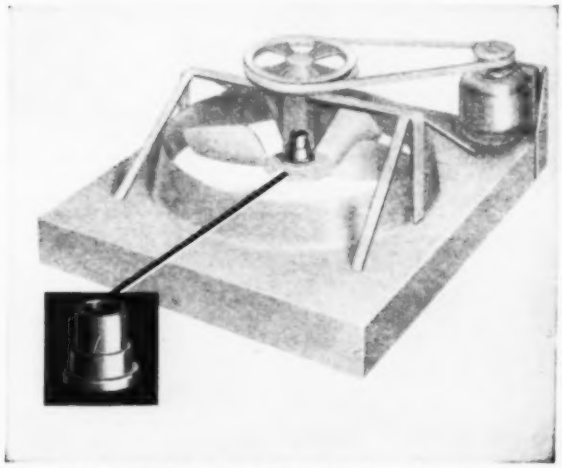


This "best seller" automatic washer is more reliable, more economical with Oilite oil-cushioned bearings.



Oilite filter-diffusers are now boosting the sale of new air tools by making them practically "noiseless".

Dust, grit, shocks — plus payloads up to 34 tons — are all in a day's work for these tough Oilite bearings.



This self-lubricating Oilite bearing refused to fail even after 125 years' service in accelerated life tests.

Quality-built OILITE®* bearings, parts and filters help sell many products by improving performance and keeping costs down. Mass-produced at Amplex's 2 modern plants, even the most intricate parts are die-pressed directly into ready-to-use, close tolerance shapes. Amplex engineering, research and production know-how can probably help you. Why not contact your Oilite representative today? Look for him in the Yellow Pages under "bearings—Oilite" or write Dept. I-10.

** Only Chrysler Makes Oilite*

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A CHRYSLER OILITE PRODUCT

the most trusted name in powder metallurgy!

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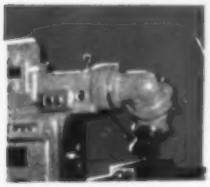
Heavy Duty Vertical Milling Attachment

Heavy-Duty Offset Vertical Milling Attachment

Universal Milling Attachment



Toolmakers Overarm

Heavy duty attachments increase versatility of dependable, low-cost

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A full line of attachments and accessories offer outstanding flexibility for all types of milling operations . . . with GREAVES MILLS.
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PLAN '59

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READER SERVICE DEPARTMENT

American Machinist
330 West 42nd Street, New York 36, N. Y.

MACHINERY BUILDER NOW INSTALLS SHAFT SLEEVES 7 TIMES FASTER THAN PRESS FIT METHOD

E. D. Jones Corp., manufacturer of paper-making machinery, uses LOCTITE SEALANT to reduce costly grinding and speed assembly.

Seven stainless steel sleeves (14" long, 9" O.D., ¾" thick) can now be installed in the same time as one . . . thanks to LOCTITE. In the old method, sleeves were precision-ground to close tolerances; time-consuming press fitting built up assembly costs.

By using Loctite, grinding tolerances can be relaxed and parts assembled with a clearance fit. Sleeves can now be *slipped* onto the shaft and positioned easily and accurately in minutes.

A film of Loctite applied to the mating parts hardens to lock the sleeve to the shaft with greater effectiveness than previous press fits. Leakage between shaft and sleeve has been eliminated.

LOCTITE is a thin liquid plastic with the unique property of converting to a tough heat and oil-resistant seal when confined between closely fitting metal parts.

LOCTITE SEALANT locks threaded parts, retains parts on shafts, seals pressure-tight joints. Write for literature and free sample

LOCTITE® SEALANT
AMERICAN SEALANTS COMPANY
121 Woodbine St., Hartford 6, Conn.
Sold by Selected Bearing and Industrial Distributors

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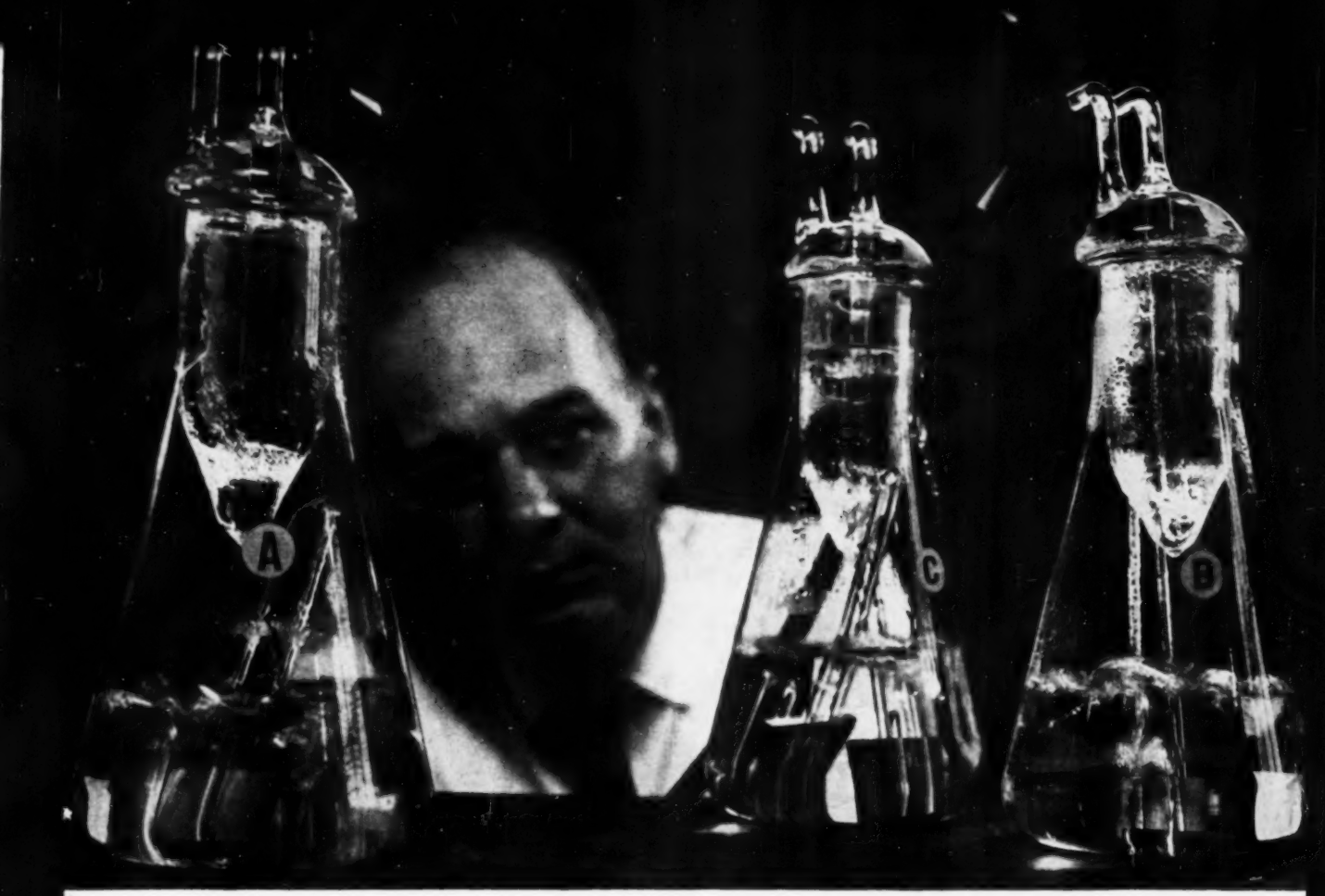

Here, boiling nitric acid is used to evaluate the corrosion resistance of Jessop stainless steel plate.

"How Jessop Tests Stainless Steel in Boiling Nitric Acid"

L. W. Cooper, Chief Metallurgist

"From experience, our customers know this is a fact: Specify Jessop for specialty steels . . . and then relax! Of the many reasons *why* this is true, here's one . . .

"In evaluating corrosion resistance, one of the procedures we use is the ASTM boiling nitric acid test. Standard and simple? Yes. But expert *evaluation* is of great importance to the customer. That's why, at Jessop, a top metallurgist closely supervises each of the five 48-hour test periods.

"*Overly cautious?* Because we're overly cautious in *every* phase of steel production and quality control, Jessop has earned the reputation for producing specialty steels tailor-made to the most exacting specs—*Specify Jessop . . . and then relax!*"

Checking the grain size of tool steel, this Jessop metallurgist uses a microscope with a camera attachment.

Green River Steel Corporation
Jessop Steel of Canada, Ltd.
Jessop Steel International Corporation
Steel Warehousing Corporation, Chicago

JESSOP
STEEL COMPANY
Washington, Pennsylvania

Stainless, alloy, tool, cast-to-shape, clad, and forging steels, ground flat stock and other specialty steels

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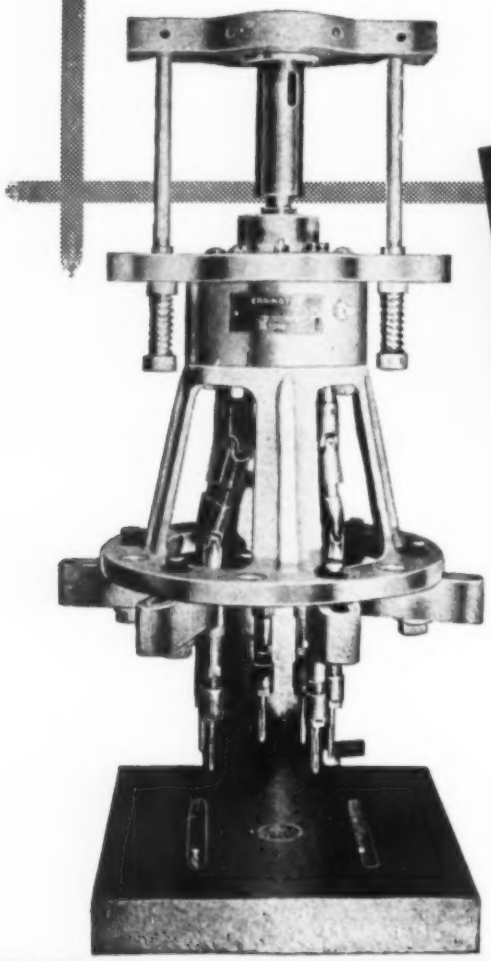
ERRINGTON

UNIVERSAL JOINT ADJUSTABLE TAPPING & DRILLING HEAD

Here's another hi-speed production tool from Errington. This dependable tool is adjustable to any pattern of holes . . . is available with 4 or 6 spindles. Positive clutch drive and reverse. Head made of the best grade sand Cast Aluminum with hardened and ground gears and spindles (made in one piece). Full grooved ball thrust bearings at all thrust points and Oilite bronze radial bearings. *Remember to do more . . . better . . . faster . . .* rely on Errington Hi-Speed Production Tools.



LESS THAN ½ MINUTE TO CHANGE HEAD FROM DRILLING TO TAPPING OR TAPPING TO DRILLING

#0—0" to ¼" Tap Capacity
Min. centers 11/16"
Max. Pattern 5¼"

#1—7/32" to ⅜" Tap Capacity
Min. centers 1½"
Max. Pattern 8"

Send For Complete Information

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Established 1891
Main Office and Plant: **STATEN ISLAND 4, N. Y.**
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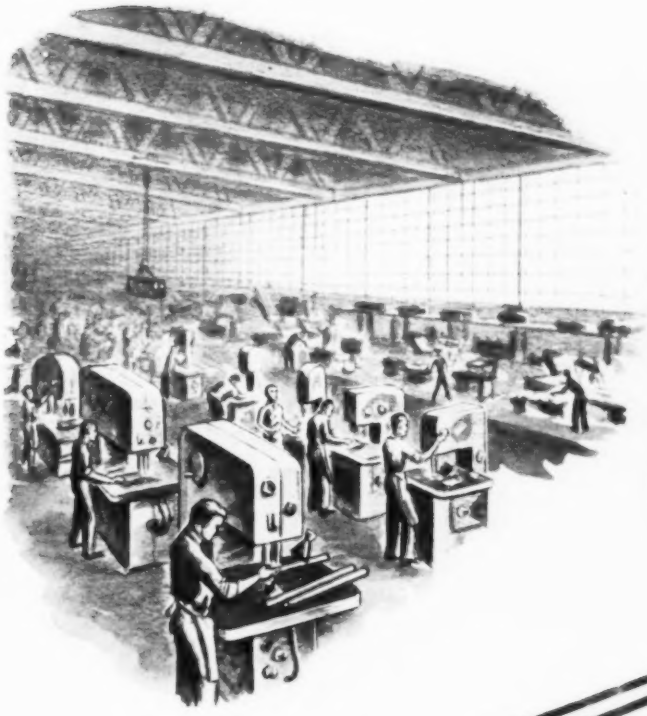
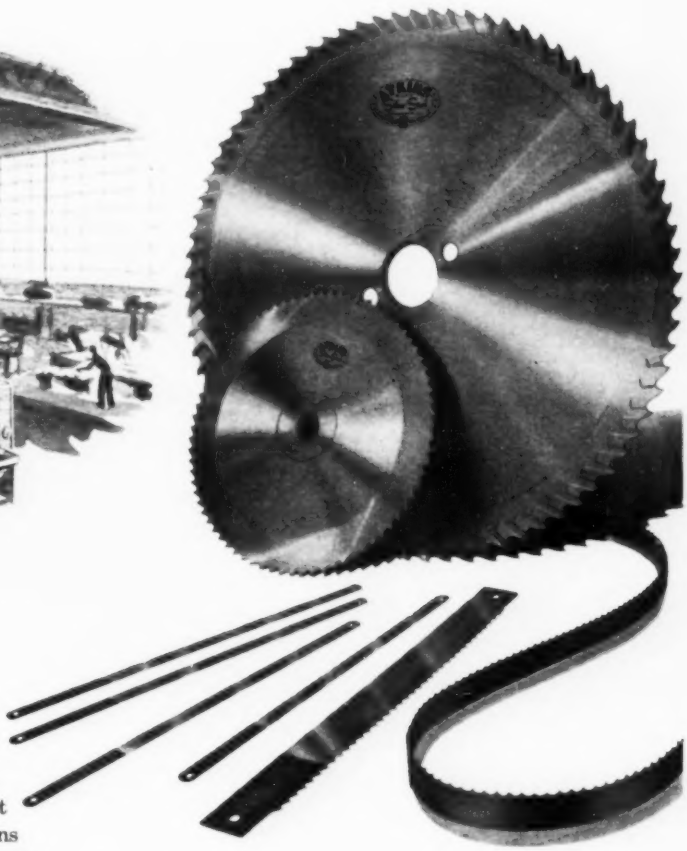
Give a man a tool he can trust

—and watch production costs go down!





A workman's skill and time on the job will be more productive when he works with tools he can depend on. A fine saw, for example . . . in expert hands or on a good machine . . . means a better product finish, less waste, fewer delays. It instills pride of workmanship and turns out *more profitable* work. That's why, throughout the metal-working industry, the best workmen are equipped for their best work with *guaranteed* . . .

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375-B

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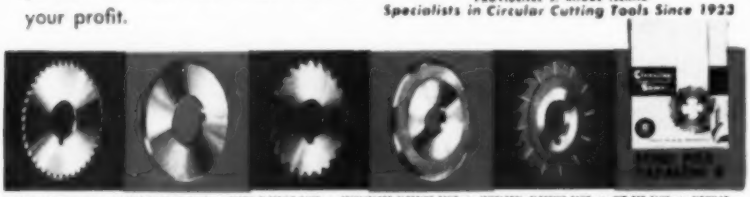
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923



METAL SLITTING SAWS • COPPER SLITTING SAWS • SCREW SLOTTING SAWS • COMMUTATOR SLOTTING SAWS • JEWELERS' SLOTTING SAWS • CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS • COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS

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American Machinist Market Dept.
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NEW RCA LIMIT-SIGNALING COMPARATOR

for both contact and air gaging

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INSTANT RESPONSE
Operates on RF frequency. No lag between contact with work and meter indication.

FAST, EASY SET-UP
Gage is linear over full scale, making it a simple matter to set up limits.

EXTREMELY VERSATILE
Can be used with standard height stand or special fixture for manual inspection, for automatic in-process, or post process inspection and segregation. Standard air-electronic adapter kit permits use for air gaging.

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"Of course, there are many reasons why I prefer ILLINOIS GEARS. I like the way they meet all our specs, the way they deliver on time, the emergency service we get when we need it—to mention a few.

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◆ ◆ ◆ Winning this recognition as the quality leader has been rightfully earned because it characterizes every step in the manufacture of ILLINOIS GEARS—a creed that established a new concept of quality in gear making.

◆ ◆ ◆ If you are not now using or specifying ILLINOIS GEARS find out about the gears that are *made right with quality as the first consideration.*

Look for this mark ILLINOIS *the symbol on finer gears*

Gears for Every Purpose ... one gear or 10,000 or more

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Useful

INFORMATION ABOUT

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Please furnish information and answers to the following problems.

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- ○ Superfine Filtering of coolants and cutting oils for production of low micro-inch finishes. For both ferrous and non-ferrous metalworking.
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COMPANY .....
ADDRESS .....
CITY ..... STATE .....

(R) IMPINJO Filter	Interceptor Separator	Magnetic Separator

GALE SEPARATOR Co.

A Division of INFILCO Inc.
GOSCO
P.O. Box 5033
TUCSON • ARIZONA

Thousands of facts on MODERN METALWORKING METHODS, MATERIALS, AND EQUIPMENT

to help you solve shop problems —advance yourself in practical machine shop work

Here is an outstanding and helpful authority for every shop man who wants to get the most out of his own time, equipment, and material, or the men he supervises. In small contract shops, in gigantic plants, thousands of copies of earlier editions are aiding shop executives, engineers, tool designers, draftsmen, master mechanics, operators, and apprentices, to get better results at lower cost. Now, in its completely reorganized and improved form, *The New American Machinist's Handbook* more than ever warrants being called the "bible" of metalworking, machinery manufacturing, and allied industries. Every one of its 1579 pages reflects modern and approved practice. Thousands of facts, figures, and formulas, hundreds of diagrams and tables, scores of shop standards, short-cuts, and timesavers are given—a selection of material of great range and usefulness.

- 80% REWRITTEN
- REARRANGED TO CONTAIN MORE FACTS—GIVE EASIER REFERENCE
- 1579 PAGES
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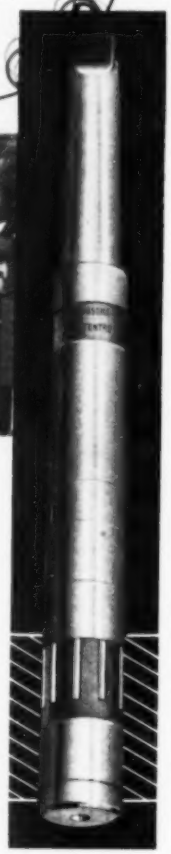

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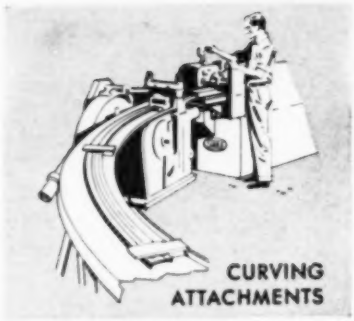

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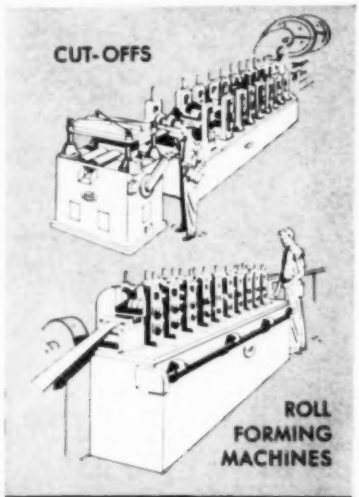

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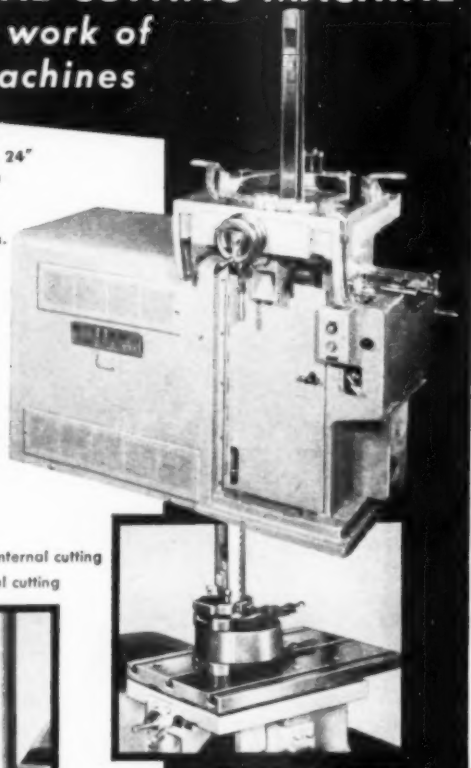
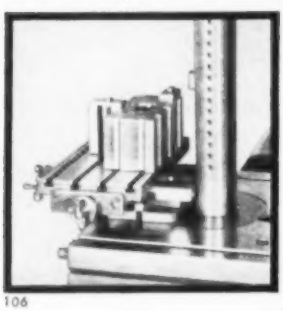


Right: Set-up for internal cutting

Below: Set-up for external cutting



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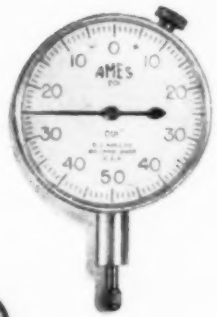

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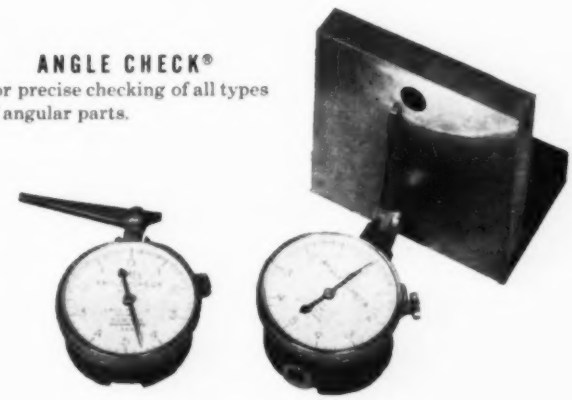

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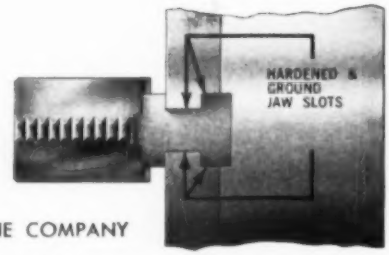

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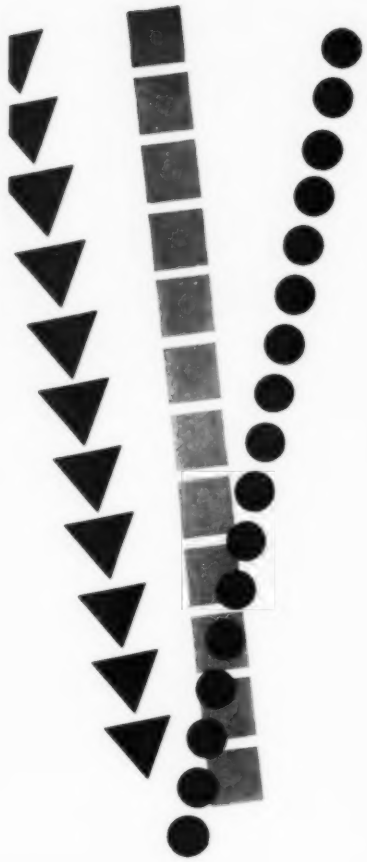

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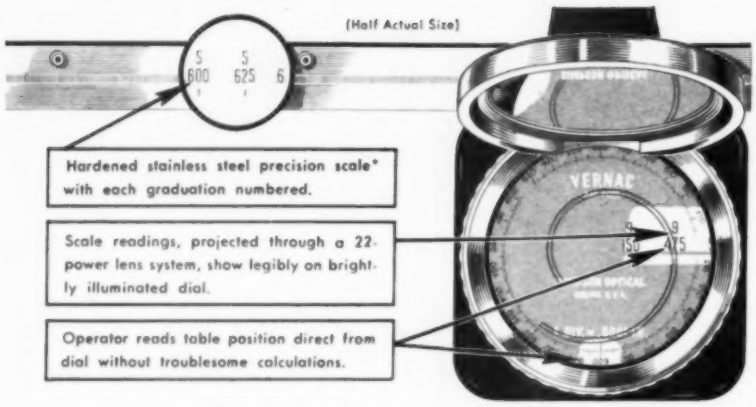
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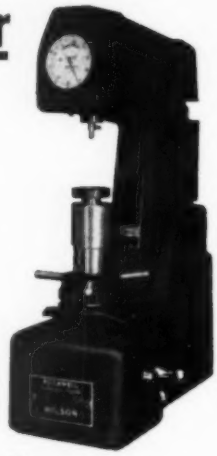

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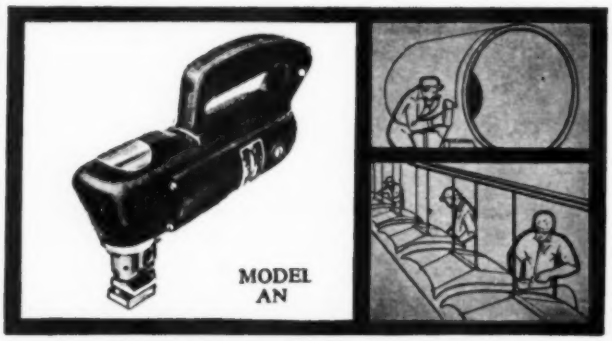

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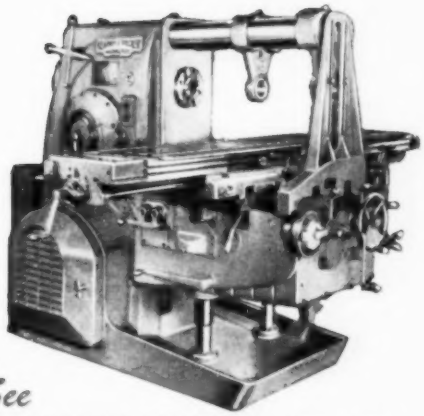

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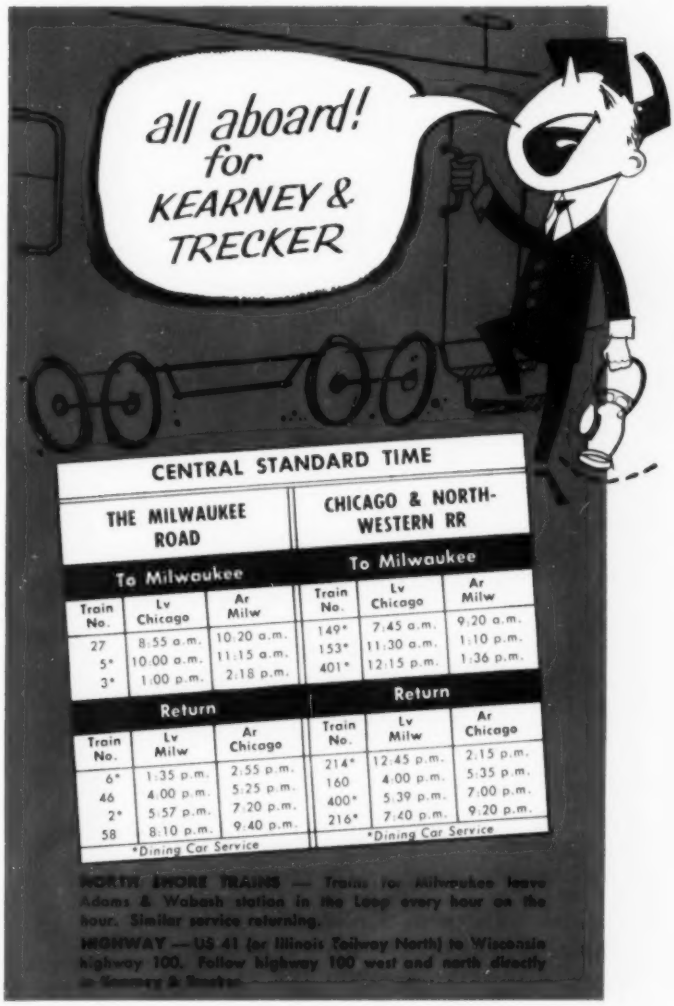

CENTRAL STANDARD TIME

THE MILWAUKEE ROAD			CHICAGO & NORTH-WESTERN RR		
To Milwaukee			To Milwaukee		
Train No.	Lv Chicago	Ar Milw	Train No.	Lv Chicago	Ar Milw
27	8:55 a.m.	10:20 a.m.	149*	7:45 a.m.	9:20 a.m.
5*	10:00 a.m.	11:15 a.m.	153*	11:30 a.m.	1:10 p.m.
3*	1:00 p.m.	2:18 p.m.	401*	12:15 p.m.	1:36 p.m.
Return			Return		
Train No.	Lv Milw	Ar Chicago	Train No.	Lv Milw	Ar Chicago
6*	1:35 p.m.	2:55 p.m.	214*	12:45 p.m.	2:15 p.m.
46	4:00 p.m.	5:25 p.m.	160	4:00 p.m.	5:35 p.m.
2*	5:57 p.m.	7:20 p.m.	400*	5:39 p.m.	7:00 p.m.
58	8:10 p.m.	9:40 p.m.	216*	7:40 p.m.	9:20 p.m.
*Dining Car Service			*Dining Car Service		

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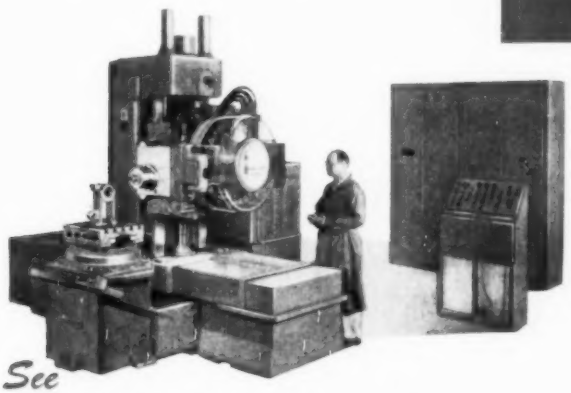

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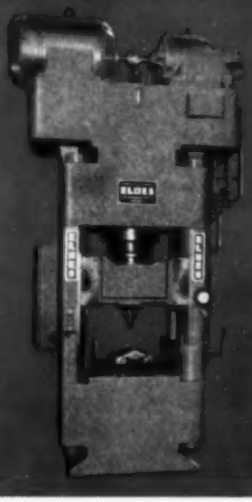
A special, fully automatic Elmes Anode Rod Straightening Press (shown above) with a unique set of dies straightens the rod and aligns the delta within commercial tolerances in one pass through the press on an overhead conveyor. A companion fully automatic Elmes press (illustrated at right) then removes the cast iron thimble, used to hold the carbon electrode to two forged steel stubs.



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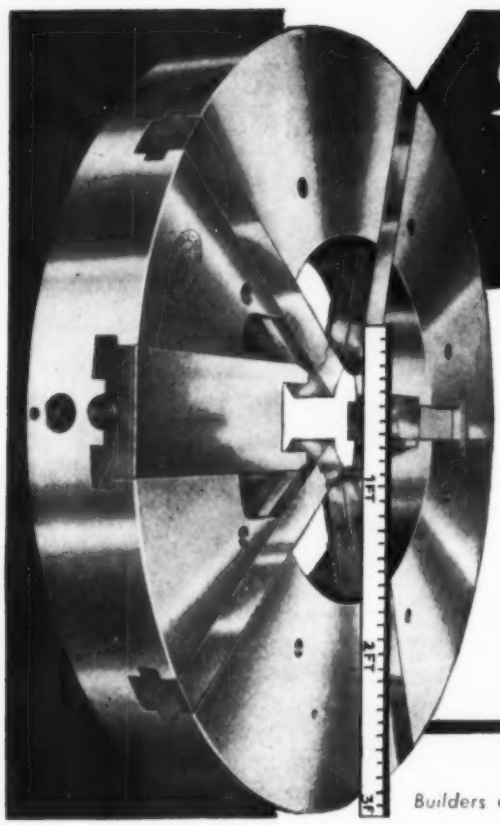

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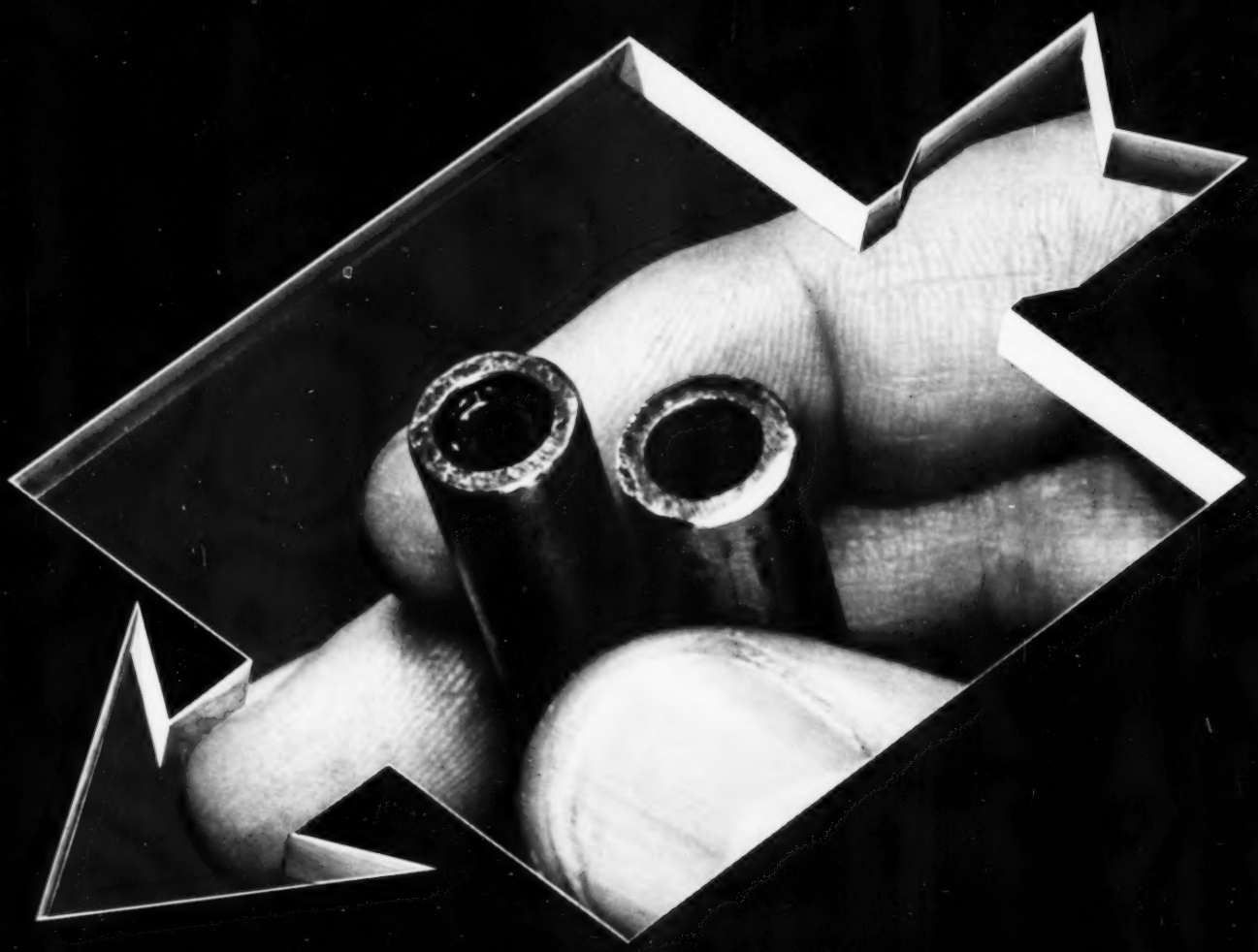

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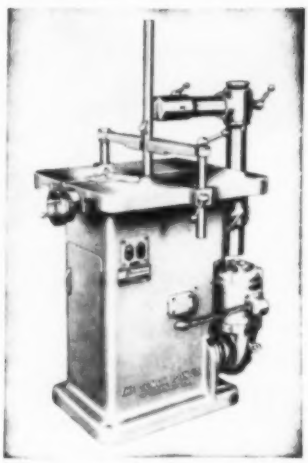

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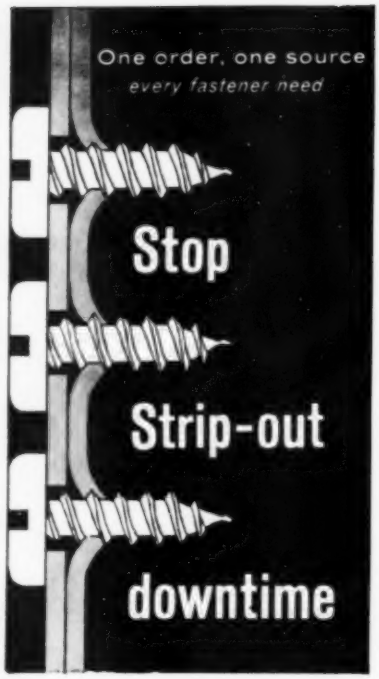
. . . that you will find more advertising for machine tools in *American Machinist* than appears in any other magazine in the world?

All of it will guide you to the best in modern machining methods and equipment. You spend time well when you spend it in the pages of *American Machinist*.



SO-HARD Tapping Screws

Production downtime in assembly operations is an expensive item—especially when strip-outs occur. So-Hard sheet metal screws end costly losses of production time. Made from specially processed steel wire, these screws are heat-treated for greater resistance to torque, shear and tension loads. True concentricity of slot to screw axis, and precisely formed threads assure the proper fit for a secure, reliable grip.

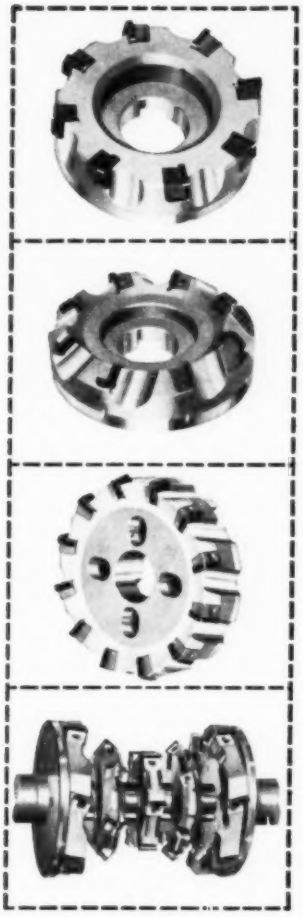
Joins metal or plastic. Available from stock in Type A and B for prompt delivery . . . all heads . . . sizes ¼" x No. 2—2" x No. 14. Southington Hardware Division, Screw and Bolt Corporation of America.

SCREW AND BOLT CORPORATION OF AMERICA P.O. Box 1708 Pittsburgh 30, Pa.
Formerly Pittsburgh Screw and Bolt Corporation
SERVES THE NATION
America's Most Complete Line of Industrial Fasteners

CIRCLE 433 READER SERVICE CARD

More Milling Possible...
Milling More Profitable
with FUTURMILL

and a handful of carbide blades



Futurmill's indexable milling cutters converted so many *slow and expensive* machining methods to *fast, low cost* operations, that they established the value of "indexable tooling" . . . recognized as one of today's most important contributions to metalworking progress.

1. Lower cost metal removal

Futurmill takes the burden out of milling with inexpensive indexable carbide blades. No need to remove the cutter from the machine . . . no more cutter grinding and no more delays and lost production time. Index a Futurmill quickly and accurately, right on the machine. Eight times per blade with negative rake cutters and four times with positive. Futurmill's precision ground blades get the finest finish obtainable and more metal removed per cutting edge.

2. Plenty of muscle for any job

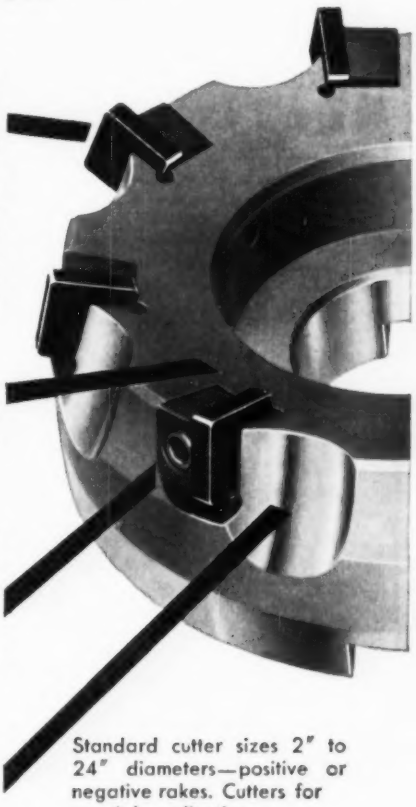
The cutter body is a solid one piece construction of heat treated alloy steel . . . not only the most rigid cutter built . . . but precision built.

3. Protection for the cutter body

The case hardened wedges behind the blades absorb the damage in case of an accident and save the cutter body . . . cutting down expense and lost production time for cutter repair or replacement . . . reducing inventory investment. With just a few extra wedges you're back in production.

4. Unobstructed chip clearance

Huge chip pockets in front of the blades direct the chips ***out and away*** from the cut—critical on steel applications and on deep cuts.



Standard cutter sizes 2″ to 24″ diameters—positive or negative rakes. Cutters for special applications.

FUTURMILL, INC.

6360 Highland Road • Pontiac, Michigan

In Canada: P.O. Box 95, Dundas, Ontario

"Get the drop" on
STAINLESS
Cutting Troubles!

A drop or two of this most amazing fluid instantly releases stuck tools . . . lets you tap, ream, drill and thread hard-to-cut stainless steels with ease and speed!

SENSATIONAL!
Rapid Tap
TAPPING FLUID

A DROP OR TWO DOES THE JOB

HOW IT WORKS

RAPID TAP immediately breaks down surface tension and adhesions and frees the tool...permitting continued rotation and pressure without fear of tool breakage. Saves tools and keeps them sharper, and reduces the number of rejected parts. RAPID TAP also improves surface finish and leaves a clean surface. RAPID TAP is highly effective in tapping, reaming, drilling, boring, threading, lathe cut-off and profile milling. Saves up to 50% of the machinist's time.

RAPID TAP is effective on most metals and alloys. NON-INFLAMMABLE NON-EXPLOSIVE.

• See RAPID TAP demonstrated at the National Metal Show — Booth 1723.

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CIRCLE 435 READER SERVICE CARD

COLUMBIA
TOOL STEELS

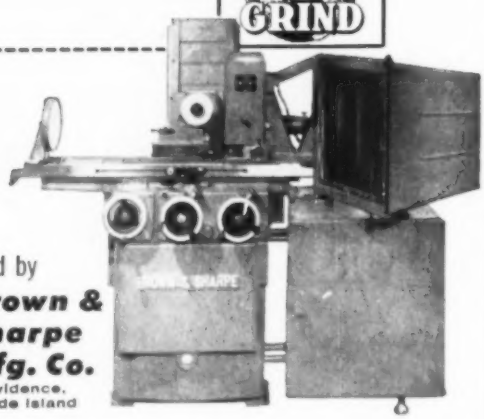
For over fifty years COLUMBIA has built its reputation on tool steel that is *good* for you

Product of Skilled American Workmen

CIRCLE 437 READER SERVICE CARD

SAVE 50%
or more in
CONTOUR GRINDING COSTS with

VISUAL GRIND



Sold by
Brown & Sharpe Mfg. Co.
Providence, Rhode Island

Visual Grind is manufactured by
The CLEVELAND GRINDING MACHINE Co.
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All about

How to Run An Engine Lathe

Here is a comprehensive *American Machinist* Special Report on one of Metalworking's most useful and versatile machines. Production executives will find this fully illustrated report particularly useful as an aid in training apprentices and new operators of engine lathes.

"How to Run an Engine Lathe" covers in detail the parts of, and operation of the engine lathe. Turning tools and the various turning operations, plus lathe attachments and care, are examined at some length.

Copies of this valuable Special Report are available to you at 25 cents each.

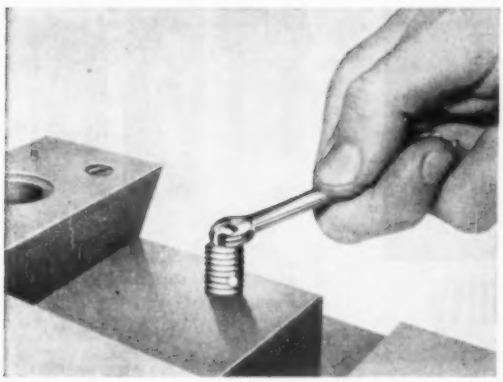
16 pages — 25 cents each

READER SERVICE DEPARTMENT
American Machinist
330 West 42nd Street, New York 36, N. Y.

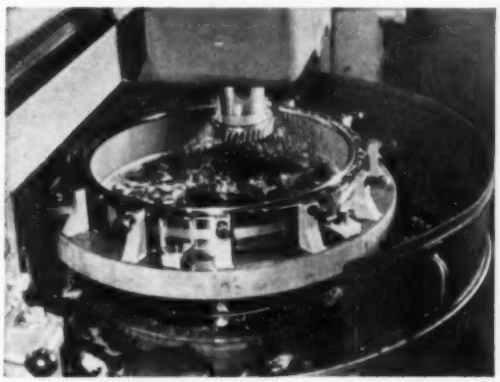
Practical Tooling Tips

No. 4 of a series

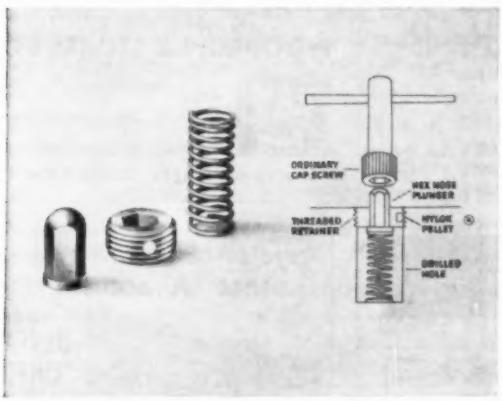
New uses are being found every day for Vlier Tooling Accessories. Perhaps the applications shown below will suggest ways you can profit by replacing costly, custom devices in jigs, dies and fixtures with precision, off-the-shelf Vlier products.



HEX NOSE SPEEDS INSTALLATION OF SPRING PLUNGERS—Vlier Hexnose Spring Plungers are easily installed with a simple end wrench. Eliminates hunting for special wrenches. Made to same exacting tolerances as Vlier Standard Spring Plungers. Available in many end pressures, diameters and lengths.



THIN-WALLED RING GEAR HELD SECURELY in fixture without distortion with 12 Vlier Torque Thumb Screws. Once pre-set end pressure is reached, knurled head spins freely, preventing overtightening. Checknut prevents backing off under vibration. Available in four types; various screw diameters and lengths.

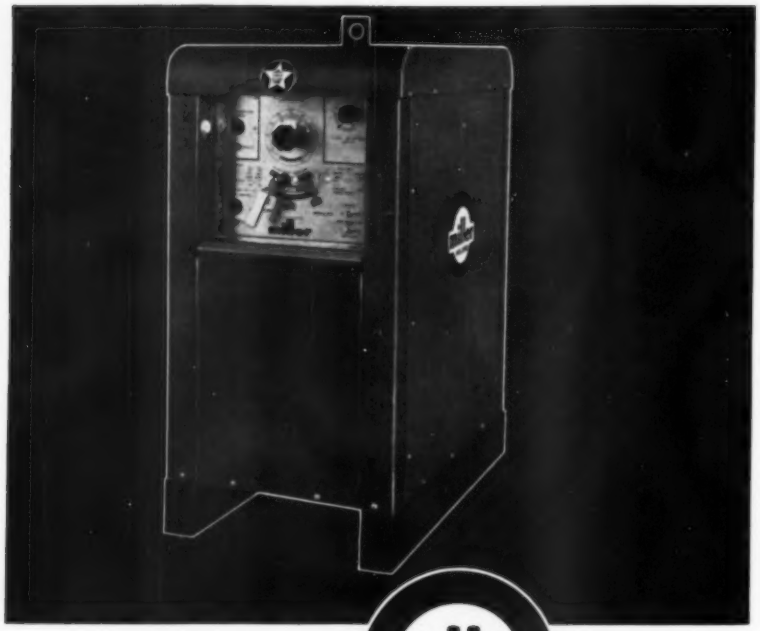


NEW PLUNGER ASSEMBLY PREVENTS DAMAGE TO DIE STOPS—Plunger actuates automatic stop perfectly. Quickly installed, never needs adjustment. Hex nose mates with standard hex head bolts for easy insertion. Nylok® nylon pellet prevents threaded retainer from working loose. 6 sizes from ¼" to 1" diameter. Various end pressures.

FREE IDEA BOOKLET—Illustrations in this 16-page booklet show how others have profited from the use of Vlier Tooling Accessories. Shows both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

VLIER
Engineering Corporation
A subsidiary of Barry Controls, Inc.
8900 Santa Monica Blvd. • Los Angeles 46, California

CIRCLE 438 READER SERVICE CARD



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. . . . becomes evident after sufficient exposure to the original cost/maintenance costs/production/profits equation.

Exploiting the full potential of better basic design, the Miller Gold Star 300 series ac-dc welders convert in minutes from the prime ac-dc welder of exceptional performance to any of these three A-C applications: Metallic Arc, manual or automatic Inert Gas; or, to any of the following D-C applications: Metallic Arc, manual or automatic Inert Gas, or Inert Gas spot welding.

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Available in 200, 300, 400 and 600 ampere models, all feature the exclusive Miller transformers and semi-metallic rectifiers. Complete specifications, including duty cycle chart, will be sent promptly upon request.

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* Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

CIRCLE 439 READER SERVICE CARD

Looking For Something?

—of course you are. Every reader of American Machinist is.

Some find what they are looking for in the editorial pages, some in the advertising by manufacturers, some in the "Searchlight" advertisements. The latter includes many advertisements seeking or offering "something" — used, rebuilt, surplus new equipment, or a business opportunity that you may be able to supply, or want.

You will always find checking the "Searchlight" ads interesting, informative and profitable.

ACCURATE SIZING and BETTER FINISH with W & S HOLLOW MILLS

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- Perfect Concentricity
- For Ferrous or Nonferrous Metals
- Diameter Tolerance ± .0001"
- Finest High-Speed Steel

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For complete information on the special tool design services of Woodruff & Stokes, write to:

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CIRCLE 441 READER SERVICE CARD

SEARCHLIGHT SECTION

ADVERTISERS' INDEX AND BUYERS' REFERENCE

Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name, indicates the products or services offered by the advertiser.

2. Automatics
4. Bending Machines
6. Boring Mills
7. Broaching Machines
9. Centering Machines
10. Chucking Machines
11. Compressors
12. Cranes
16. Drilling & Reaming Machines
23. Gear Cutting Machines
24. Grinding Machines
26. Honing & Lapping Machines
28. Keyseaters
29. Lathes
33. Milling Machines
37. Planers
40. Press Brakes
41. Presses
45. Riveting Equipment
50. Shapers
51. Shears
52. Sheet Metal Machinery
56. Threading & Tapping Machine
58. Welding Equipment

ADVERTISER	Page No.	KEY TO PRODUCTS OR SERVICES
Cincinnati Machinery Co.	350	6, 10, 24, 29, 33, 37, 50
Eastern Machinery Co.	350	6, 9, 10, 11, 24, 29, 41, 45, 50, 52, 56, 58
Emerman Machinery Corp.	351	2, 6, 7, 16, 23, 24, 26, 29, 33, 41, 51
Falk Machinery Co.	349	16, 24, 29, 33, 41, 50
Hunter Machine Co., James	350	51
Hyman & Sons, Joseph	349	40, 41, 51
Republic Machinery Co.	349	6
Wheeler Manufacturing Co., C. H.	350	4, 6, 12, 16, 28, 29, 33

SEARCHLIGHT Equipment Locating SERVICE

"No Cost or Obligation"

This service is aimed at helping you, the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

How to use: Check the dealer ads to see if what you want is not currently advertised. If not, send us the specifications of the equipment and/or components wanted on the coupon below, or on your own company letterhead to

SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o American Machinist
Classified Advertising Division, P.O. Box 12, N. Y. 36, N. Y.

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

Searchlight Equipment Locating Service, c/o Classified Advertising
AMERICAN MACHINIST, P. O. Box 12, N. Y. 36, N. Y.

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TITLE ..... COMPANY .....

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10/19/59

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Every Item Guaranteed as Represented

No. 3, No. 4 CINCINNATI Vert. & Horiz. H.S.D.T. Mills, Late Type.

24", 36", 42", 54" BULLARD Vert. Turret Lathe, Turret Hd., Side Hd., M.D. Spiral.

No. 2, 4, 5, 1A WARNER & SWASEY Univ. Preselector Turret Lathes, Bar Feed & Chucking.

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3'x11' 3'x13" Cinci-Bickford Super Service Motor on Arm. Radial Drill.

4" x 18" CINCINNATI Cyl. Grinder, Late.

1, 2, 6-Sp. No. 2 LMS—26" LELAND-GIFFORD Drill Presses, Power Feed Backgeared. Late Type.

20" ROCKFORD Hydraulic Shaper, Vise, M.D., Late Type.
20" ROCKFORD Vert. Hyd. Slotter, 1953.

No. 3V VAN NORMAN Ram Type Vert. Mill, Late Type.

32" x 12' centers FARREL Traveling Table Type Roll Grinder, Excellent condition.

No. 2H, 4K KEARNEY & TRECKER Horiz. Mills, Late Type, M.D.

OVER 1000 MACHINE TOOLS AVAILABLE IN STOCK . . . SEND US YOUR INQUIRIES

BUY FROM STOCK — *Telephone* BAKER 5-5887 — 10 WARD ST. ROCHESTER 5 N. Y.

CIRCLE 500 READER SERVICE CARD

6 EXCELLENT 6
Horizontal Table Type
BORING MILLS!

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All with 2" 1500 RPM. Spdle.

1—4½" #26 DEFIANCE, with 800 RPM. Spindle
1—3" UNIVERSAL, 650 RPM.

ALL LATE — GUARANTEED
SEE UNDER POWER

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WILL LEASE WITH OPTION TO PURCHASE, OR WILL FINANCE OVER LONG TERM

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CIRCLE 502 READER SERVICE CARD

Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY

SHAPERS

6" Pratt & Whitney M1506, Model B Vertical
12" Rockford Universal Hydraulic, Sanged m.d.
12" Hendey Universal Back Geared, m.d.
24" Gemco Standard Duty Universal, m.d.
24" Amer. Stand. Pat. Auto-Oiled Plain Shaper, m.d.
24" Rockford Hydraulic, m.d.
32" Morton Draw-Cut, m.d., late
32" Cincinnati, m.d., late
38" Morton Punch Cut Shaper, m.d.
48" Morton Heavy Duty Traveling Head, m.d.

SHEET METAL MACHINERY

No. 3⅝" capacity Gray Sheet Metal Cutter, m.d.
No. 11-SBC Buffalo Armor Plate Bar Cutter, m.d.
Mod. 1236 Libert HI Speed Nibbler Type Shear, m.d.
No. 5 Hilles & Jones Pyramid Type Bending Roll
U1144B Pexto Underdriven Power Squaring Shear
Mod. SP Dreis & Krump Hand Type Box, Pan Brake

SLOTTERS

18" Niles-Bemont, s.p.d.
20-24" Pattern Dill, m.d.
20" stroke Rockford, m.d.
22" Betts, m.d.
48" Niles, m.d.

TAPPERS

No. 1 Bakewell, m.d., late
No. 10 Model 2100 W & S Bench Model, m.d.

TURRET LATHES

Model ESM-50 Hardinge Precision Ram Type, m.d.
No. 1 Warner & Swasey "Electric", m.d., bar
No. 1S-25 Acme Saddle Type, m.d.
No. 1L Gisholt Universal m.d., 1943
No. 1A Warner & Swasey, m.d., late
No. 2 Bardons & Oliver Ram Type Electric, m.d.
No. 2L Gisholt, m.d.
No. 2H8, Libby, 1942
No. 3 Gisholt, m.d., 1945
No. 3A Warner & Swasey, m.d.
No. 3L Gisholt, m.d., 1943
No. 3AL Gisholt, with cross sliding turret, 1940
No. 4 Midland Universal Ram Type, m.d.
No. 4 Warner & Swasey Universal Ram Type, m.d.
No. 4 Gisholt, 1943
No. 4A W & S Universal Hollow Hexagon, m.d.
No. 4A W & S Universal, m.d., chucking, 1939
No. 4L Gisholt Universal, m.d.
No. 4FU Foster Fastermatic, m.d., latest, 1945
No. 4H-12 Libby, m.d.
No. 4R Libby Ram Type, m.d. in base
No. 5 Midland, m.d.
No. 5 Gisholt, Ram Type, m.d.
No. 5L Gisholt, 1946
No. 6.2 Denver Acme Ram Type Universal, m.d., 1944
No. 7 Bardons & Oliver, m.d.

MISCELLANEOUS

No. 90H Williams & White Justice Hammer, single pulley drive
No. 125 Marken Marking Machine, m.d.
Swiaky Type PMCO-25-S1 Storage of Energy Spot Welder, 50-KW, 24" throat
P&W Standard Measuring Machine, 39" capacity
15" Gleason Quenching Press
LeRoi Electric Power Plant
38" face Plate, Lathe, taper nose key mounted, new
18"x60" O.S. Walker Magnetic Chuck
Clamp Assembly to fit 6.2 Denver Acme Turret Lathe
1 ton Shaw Electric Cable Hoist
Brown & Sharpe Universal Attachment, for use on 2A Brown & Sharpe Miller
63" Walker Rotary Magnetic Chuck, 230V D.C., new
Magatherm H.S. Induction Heating Unit
No. 74 Heald Workhead Assembly
6" Victor Swivel Vise, new
24"x24"x2" thick Diamond Cast Iron Lapping Plate
No. 00 Ingersoll-Rand, "Multivan" Air Operated Hand Grinder, new
No. 1A Grant Riveter
King Boring Mill Table, 32" diameter, 4 jaw independent chuck, new
48" dia. Cleveland Universal Jig Co., Rotary Table
53" dia. Cleveland Universal Jig Co., Rotary Table
Jones & Lamson Auto. Die Head Hartness No. 7H
No. 26 Norton Hydrolap, m.d., late
Cincinnati Vertical Boring Mill Right Hand Side Head with Turret
Type 114-CB Moline Tool Bar, Mach., 2 sp. type.

THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1-1241
CABLE ADDRESS EMCO

CIRCLE 503 READER SERVICE CARD

Cimco

SELECT MACHINE TOOLS

9" bar Giddings & Lewis, 2" auxiliary bar, high speed, late type.
30" x 29' cc LeBlond Hv. Duty G. H. Lathe, late type, 2 carriages, tapers, swings 34½", 16 speeds.
14' x 12' x 30' Betts Double Housing Planer, 50 HP DC motor, 4 heads, box table. ACTUAL PHOTOGRAPH AVAILABLE.
#4 Cincinnati Dial Type Universal Mill, medium speed, late type.
18" x 40" x 96" centers Norton Type "C" Cylindrical Grinder, two gaps, swing 40" and 28" in gaps, mechanical feed, late type.
20" Gould & Eberhardt Industrial Shaper, vise, front support, new 1947.
22" x 24' centers Monarch Model CM Geared Head Lathe, actual swing 27½", 16 speeds, two Carriages, tapers.
43T Giddings & Lewis table type boring mill, table 40 x 48, outer support, late type.
Model 300 Hanchett, 13 x 48" table, complete with magnetic chuck and rectifier, late type.
#5 Warner & Swasey, Preselector head, late type.
#4 Jones & Lamson, 2-1/16" hole in spindle, 12" 3 jaw chuck, late.
48" x 48" x 20' Niles Bement Pond Planer, 4 heads, electric tool lifters, latest.

Cincinnati Machinery COMPANY
3901 Kellogg Ave., Cincinnati 26, Ohio
Phone TRinity 1-0853

CIRCLE 504 READER SERVICE CARD

OVER 1,000 NEW AND USED MACHINE TOOLS IN STOCK
WRITE FOR LATEST STOCK LIST

MILES MACHINERY COMPANY
2039 EAST GENESEE • SAGINAW, MICH. PL. 2-3105

CIRCLE 505 READER SERVICE CARD

USED MACHINERY FOR SALE

One used D & H floor type, horizontal boring, milling and drilling machine, 6½" bar, horizontal travel—24 ft., vertical—12 ft., bar travel—62 inches. Power R.T. to head and column.

One #5 Gisholt Universal Turret Lathe, automatic chuck and bar feed. Threading attachments, pump, etc.

Three #3 Gisholt Universal Turret Lathes, automatic chuck and bar feeds (one has extended bed—24" extra length), pump, etc.

One #1-L Gisholt Universal Saddle type Turret Lathe, automatic chuck and bar feed. Taper and threading attachments to cross slide, pump, etc.

One Baker, Model #25 Keyseater—S.P.D.

One #2-20 Kent-Owens Vertical Mill #40 taper in spindle pump and one set of change gears.

One Hossfield power bender with Vickers hydraulic system and some dies.

One 10-ton Northern Engineering Works Crane complete with controls for 230 volt DC operation. Span: 66'0"; Lift: 25'. Clearance required (top of rail to lowest point of obstruction) 70".

Address replies to:
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19th & Lehigh Avenue, Philadelphia 32, Pa.
Attn: Mr. Albert J. Collet

CIRCLE 506 READER SERVICE CARD

WIDOW MUST LIQUIDATE

OVER ONE MILLION DOLLARS INVENTORY. BALL & ROLLER BEARINGS. NEED SALESMAN OR MANUFACTURERS REPRESENTATIVE. WILL PAY HIGHEST COMMISSION. PLEASE CONTACT

SW-2833, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

CIRCLE 507 READER SERVICE CARD

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Three or more years' experience in tooling and methods determination, plus an engineering degree, will qualify you for this exceptional opportunity. Should be familiar with manufacturing processes of precision machine parts from drawings through finished products. Knowledge of operation sheets, forgings, castings and hydraulics desirable in the aircraft industry. $8000-$9,600 plus profit sharing in an expanding suburban Buffalo engineer-directed company.

MOOG SERVOCONTROLS, INC.
Manufacturing Engineer
East Aurora, New York

CIRCLE 508 READER SERVICE CARD

FOR SALE

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CIRCLE 509 READER SERVICE CARD

LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTs OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF American Machinist published Bi-weekly at New York, N. Y., for Oct. 1, 1959.

1. The name and address of the publisher, editor, managing editor, and business managers are: Published by McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N. Y.; Editor, Burnham Finney, 330 West 42nd Street, New York 36, N. Y.; Managing editor, Anderson Ashburn, 330 West 42nd Street, New York 36, N. Y.; Business manager, J. J. Hogan, 330 West 42nd Street, New York 36, N. Y.

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4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

McGRAW-HILL PUBLISHING COMPANY, INC.
By JOHN J. COOKE, Secretary

Sworn to and subscribed before me this 10th day of September, 1959.
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(My commission expires March 30, 1961)

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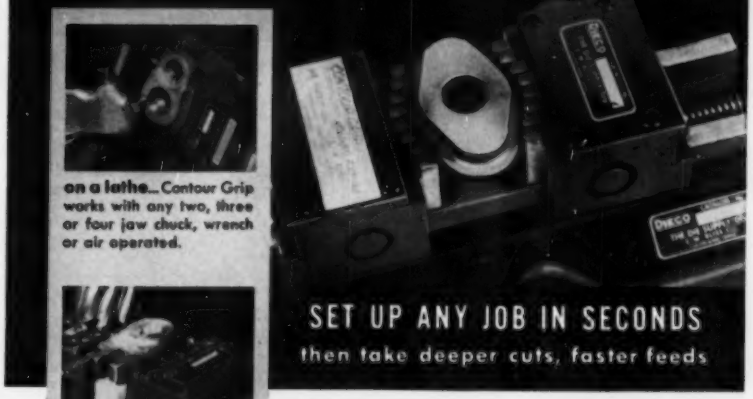

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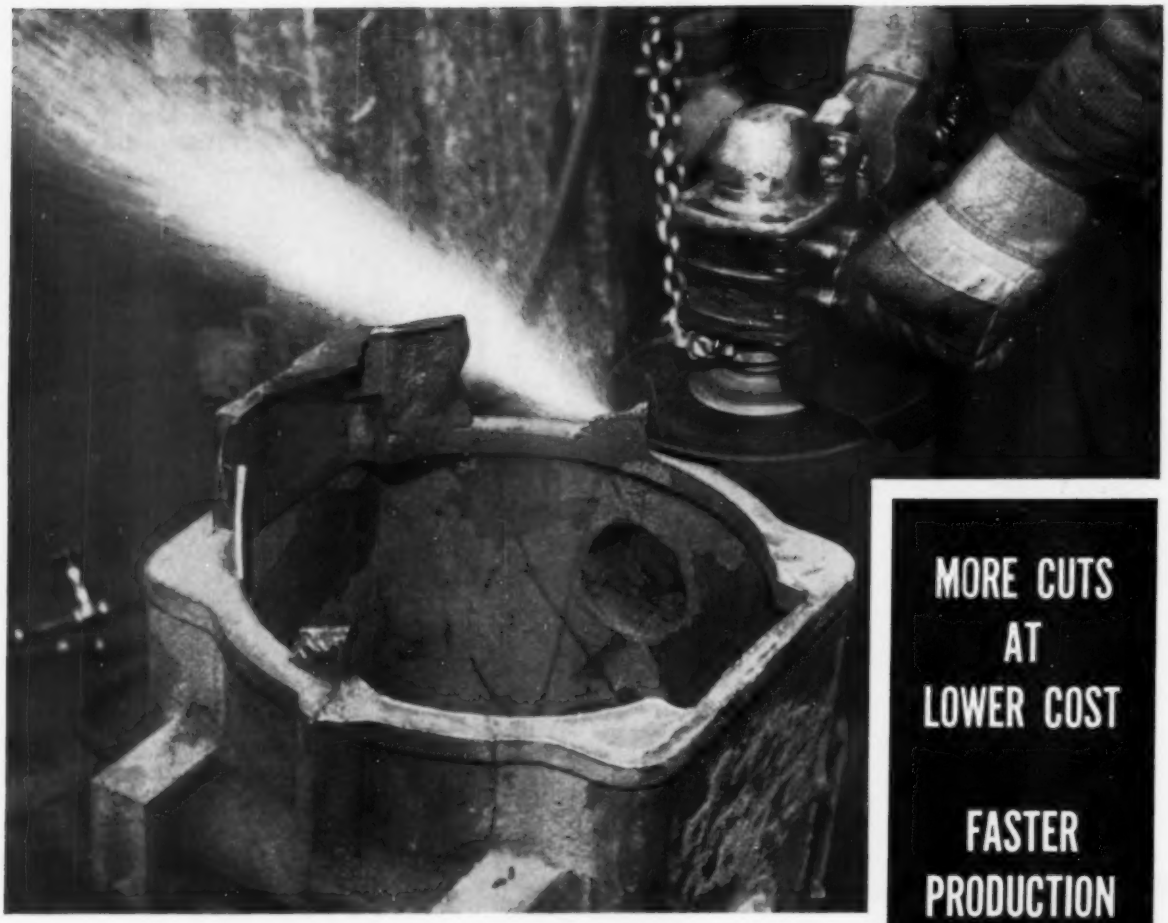

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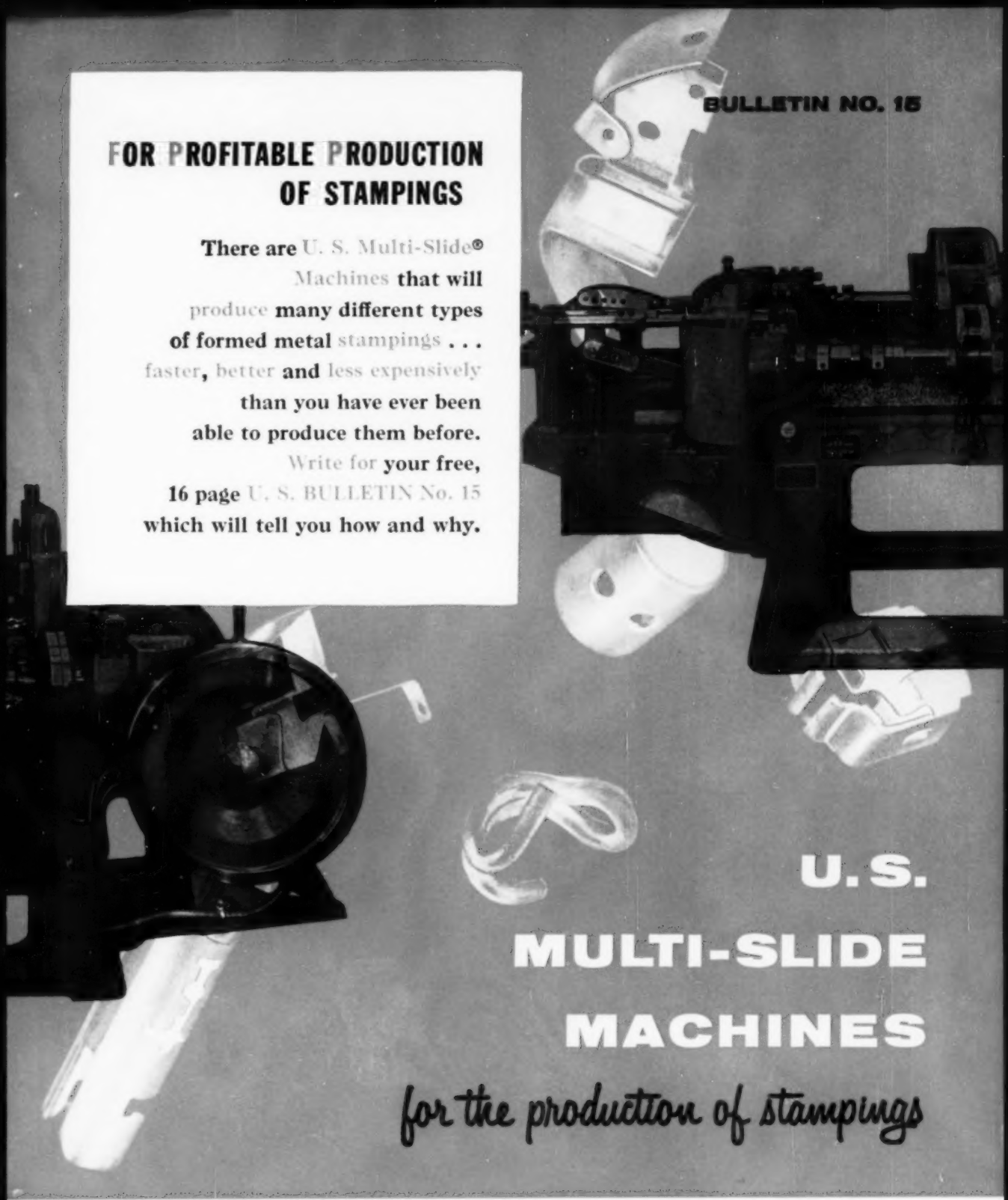

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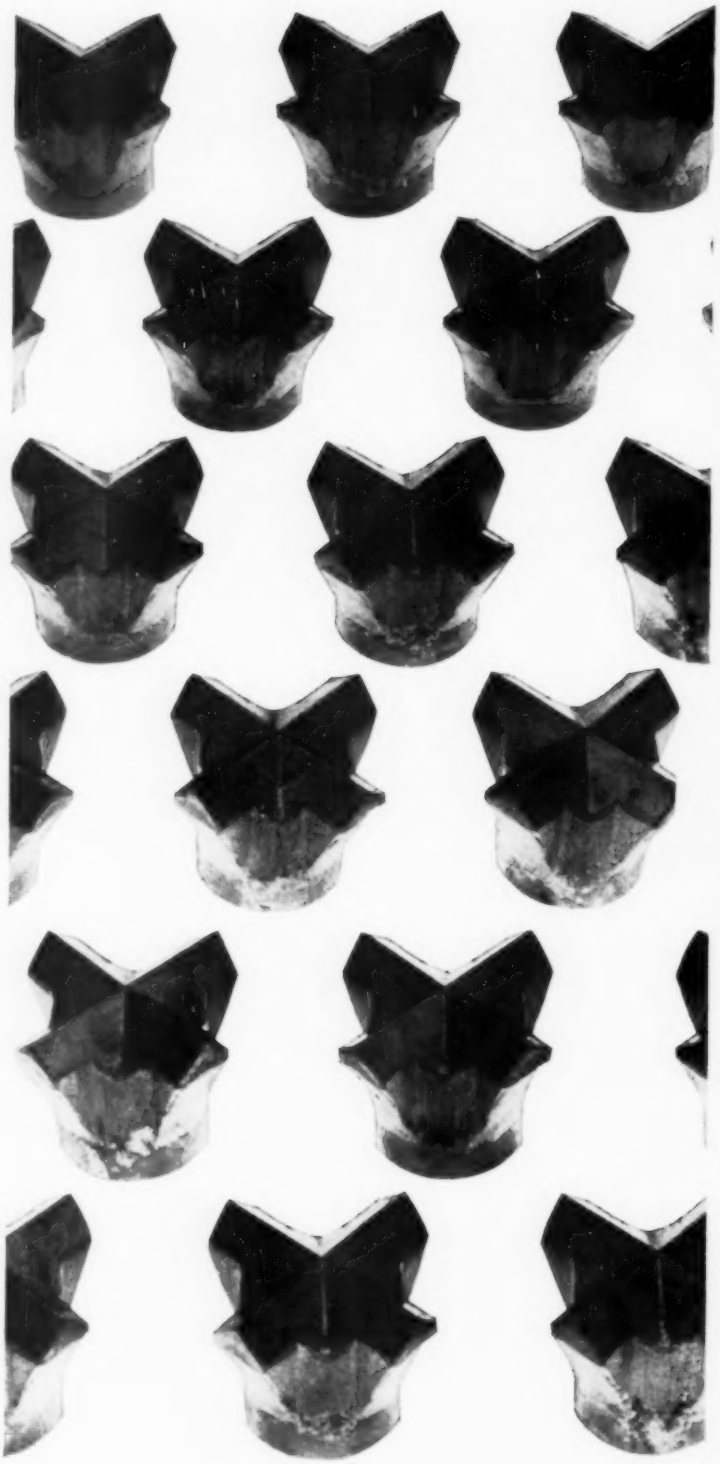

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